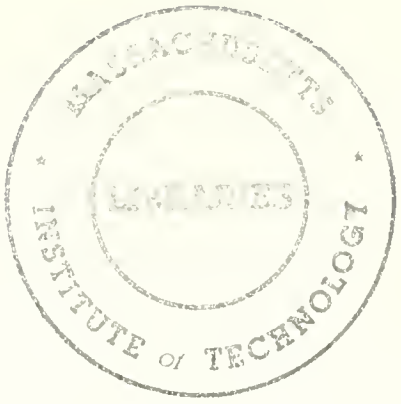
MASSACHUSETTS
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GOVERNMENT SUPPORT OF INDUSTRIAL RESEARCH AND DEVELOPMENT THE ISRAELI EXPERIENCE

by

Samy S. Ofri

Working Paper #1765-86 March 1986

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ABSTRACT.

This paper describes the program of government support for industrial research and development in Israel. The main objective of this program is to increase the export of innovative, technologically sophisticated products from Israel.

The first chapter gives the history and the background of the program. The second one describes the special problems of Israel, and gives an overview of the program and its principles of operation. The next chapter describes the direct financial support, including criteria for project approval, preparation of proposals, recognized expenses and payments and contractual obligations. The next chapter describes the special programs intended to promote industrial R&D at universities and research institutes. Another chapter describes tax shelters and other venture capital incentives.

The second part of this paper describes programs of binational cooperation in industrial research and development. Special emphasis is placed on U.S. - Israel cooperation (BIRD F), and two chapters describe in great detail the principles of operation, the problems and the achievement of this program. The two last chapters describe four other programs of binational cooperation.

CONTENTS.

HISTORY AND BACKGROUND.

Historically, the Israeli technical infrastructure has been based on three major foundations - (1) Agriculture, (2) Pure Science, and (3) Defense. Each of these areas resulted from the particular geopolitical situation in which Israel found itself.

Before the State of Israel was founded and in its early days, self-sufficiency was the first order of business. This, combined with the small area, poor soil and meager rainfall led Israel to concentrate on advanced agricultural methods in order to make the most of what it had. Anyone who sees Israeli Kibbutz agriculture now cannot help but be impressed with the most up-to-date chemical, mechanical and computerized techniques which are used.

Among the immigrants who make up most of Israel's population, the percentage of scientists is extraordinarily high. 50,000 scientists and engineers now in the country reflect one aspect of the Jewish thirst for learning and intellectual achievement. This tradition continues in the Israeli institutions of higher learning, which have trained an ever increasing number of native born Israelis in scientific and engineering disciplines. About 3000 graduates from local academic institutions join this technical reservoir each year. However, as we shall see, only recently have the scientists in physical and biological fields been able to contribute to the country's economy through industrial R&D.

Israel's well known security problems have led to an unusually high percentage of the national income being invested in defense. By the mid 50s, the increased defense demands of Israel necessitated the formation of the military industry, and resulted in the manufacture of diverse weaponry based mainly on imported technology. Within a span of 10 years this industry accumulated enough experience and knowledge to enter the field of R&D in order to satisfy the specific demands of the Israeli Army. Spin-offs of technological development in the military industry helped create the basis for the civilian science-based industry in the late 60's.

These three underpinnings of Israeli technology did not really make an impact on the economy until the early seventies. The Israeli government was relatively slow to realize the wide gap between technological and scientific potential on one hand, and industrial output, especially as reflected in exports, on the other hand. This was true despite the fact that the government was trying to organize and coordinate research and development almost from the establishment of the State.

In 1950 the Government formed the Research Council of Israel (later renamed the National Council for Research and Development) and charged it with the responsibility "to organize and coordinate research in the natural and technological sciences, to encourage and implement scientific research that is likely to advance industrial and agricultural developments, and to exploit the natural resources of the State of Israel". The Council concentrated on the infrastructure for implementing activities in the technological sciences, mainly through the establishment of research institutes. Israel's industrial firms were below the critical

size needed to establish and maintain normal R&D activities, and the raison d'etre for those institutes was to provide industry with their needs for R&D and testing services. Similar but less systematic activities were carried on in academic institutes which considered such activities as a side line and at the individual researcher preference.

The National Physics Laboratory was the first institute to be established for this purpose (1950). Soon followed the establishment of the Institute for Fibers and Forest Products, and the Desert Research Institute. Later, three additional associations for R&D (Institutes) were formed, Rubber, Ceramic and Silicates and Paint. These research and service institutes were under the combined sponsorship of the Government and the appropriate industry. Two others, metals and fermentation, were established as a combined effort of the Government and academic institutions.

By the mid 60s, a general consensus in government, industry and the research community that all these efforts had failed to make a real impact on the economy existed, and that a major reorganization of the Government administration of R&D was needed. In 1966 the Prime Minister appointed a Committee under the Chairmanship of Prof. E. Kachalski (later to be elected the President of Israel), and assigned it the task to investigate and recommend principles for reorganizing and operating Government R&D activities. In 1968 the Committee's recommendations were presented, and subsequently approved in essence by the Government. The main highlights of the Kachalski Committee's recommendations were:

1) Charging ministries, whose duties bring them in contact with technological R&D, to define R&D needs and their order of priorities, and provide appropriate budgets for such needs. Each such ministry was to appoint a Chief Scientist.

2) All research institutes, whether partially or wholly government owned were grouped according to their goals, and the Government responsibility for this operation was placed with the Office of the Chief Scientist of the appropriate Ministry. Thus, the Industrial Research Administration at the Ministry of Industry and Trade, with 8 R&D institutes was formed.

3) The National Council for Research and Development was to become a central body for the formation of national policy for R&D and for promoting R&D of national importance in topics which are outside of the immediate interest of the Chief Scientist's Office.

The establishment of the Office of the Chief Scientist (OCS) which included the above mentioned Industrial Research Administration, at the Ministry of Industry and Trade, was a beginning of a dramatic change in the atmosphere towards, and activity in, industrial research and development within the Government, industry and academic institutions.

The Office of the Chief Scientist embarked on a very extensive program of financial support for industrial R&D, tax credits and tax shelters, programs of international cooperation, all of which will be described in great detail in the following chapters. As a result of all these activities several dramatic changes occurred:

1) When the State of Israel was formed, the only industry that existed in this country was a traditional consumption industry. This industry which was mainly labor-based or capital-based, was directed towards the needs of the local market only. In the early 50's, when there was a great influx of immigrants, a whole range of this type of industry was established in order to supply employment to the newcomers, rather than to advance the economy. Industrial R&D was non existent, and it only began to sprout in the late 60's as a spin-off of the military R&D. When the OCS program started in the early 70's, only about half a dozen companies were engaged in civilian R&D. By 1985 some 770 companies could be identified as engaged in about 1200 projects in industrial R&D.

2) The economic impact of the program was even more dramatic. In 1972 the export of technologically sophisticated products based on local industrial R&D was $25 million. This figure grew to $230 million in 1976 when we established the target figure of $1 billion worth of exports by 1980. And indeed the exports of R&D products kept growing, $330 million in 1976, $550 million in 1978, $750 million in 1979, and the coveted figure of $1.05 billion in 1980. The last year for which figures are available is 1984 - $1.8 billion. Israel's present announced target is to achieve $5 billion worth of R&D products exported by the end of the decade, and this is, not incidentally the foreign trade gap of the State of Israel. A more detailed breakdown of the exact export figures, as well as the basis for the forecasts, is included in one of the following chapters.

3) Due to various budgetary constraints, the budgets of the Universities kept sinking, while at the same time the government, encouraged by the success of the industrial R&D program kept increasing the budget of the OCS. As a result many bright young scientists (and many not so young), flocked to join industrial firms and carry out industrial R&D. Senior research scientists at the institutes of higher learning found it is far easier to obtain grants for industrial R&D rather than pure research. Today some 3500 scientists and engineers are engaged in industrial R&D at various industrial enterprises, while many more do subcontracting work at the various universities. They find the work challenging and interesting, and the economy has finally begun to profit from the unusually high percentage of good scientists and engineers.

4) The widening of the technology-based industrial infrastructure in Israel has had a quite important side effect on the population of developing regions where such industries are encouraged to locate. The presence of such industries causes sophisticated manpower to move into these towns, and encourages local people to advance their training and to take advantage of the new opportunities and challenges. This process as a whole creates the trend for sophistication which raises the general level of education of the public, their economic status and the quality of life.

The purpose of this paper is to describe in detail Israel's program of government support for industrial research and development, its principles of operation, the philosophy behind it, the problems encountered and how they were solved. Separate chapters will be devoted to the interaction between universities and industry, to the marketing of R&D products, to the problems of the industrial R&D institutes and to case histories. Special emphasis will be given to binational cooperation in industrial R&D. Israel's binational experience is unique, and after several years of operation, the time has come to pause a little, put some of that experience on paper, and draw some conclusions.

GOVERNMENT SUPPORT OF INDUSTRIAL R&D

During the past ten years, the Government of Israel has become more and more convinced, that at least part of the solution to its economic problems may come through industrial R&D and the development of innovative industry. Water resources and arable land have reached almost peak use; the further expansion of agriculture, as sophisticated as it might be, is expected to be only marginal. At the same time, Israel cannot and should not try to compete with labor-based or capital-based industry; the Israeli worker cannot compete in productivity or in salary with his Far East counterpart; nor is the country particularly rich in natural resources. On the other hand, Israel considers its highly qualified manpower as one of its most important assets which gives it a relative advantage over others in the development of an advanced industry. Innovative industry seems to promise unlimited potential growth, considering the rapid expansion of demand in the world markets and Israel's growing reservoir of skilled manpower and knowhow. It thus became obvious that the future of Israel, which depends greatly on economic strength and growth, absorption of new immigrants, raising the standard of living and maintaining its survival ability, rests significantly with the innovative industry. Great emphasis has therefore been placed on encouraging that industry and providing it with financial, technological and other forms of incentives to accelerate its growth. But such support may not be effective if one does not analyze carefully the inherent constraints of the Israeli technological innovation as a small country.

THE INHERENT CONSTRAINTS ON ISRAEL INDUSTRIAL TECHNOLOGICAL INNOVATION

It seems that the main constraints Israel faces as a small country, when it plans how to convert the relative advantage it has in scientific and technological potential into what may be called "tangible benefits", are the following two:

1) Small local market.
2) Competition in high technology with huge companies in the world market.

The small local market reflects many disadvantages on Israeli industry: although in many cases it becomes a captive market, its small size prevents the industry from setting up a reasonable mass production system, and it also eliminates the possible gradual growth of production from commercialization for the local market to production for export. For many innovative products, Israel locally can serve at best as a "piloting market".

It can easily be shown that the local market is not attractive enough for the hundreds and thousands of innovative products being developed in Israel. Furthermore, one of the most important national goals is to increase industrial export. Industrial R&D and innovations appear to be the major tool to achieve this goal, as it was previously pointed out.

The world market, being thousands of kilometers away from the industrial enterprise, and distributed over many countries, creates a

scenario which has to be understood and considered very precisely. One possible way to bridge these distances is the promotion of international cooperation, when the R&D and production are done in the Israeli plant and the marketing phase is done by the counterpart abroad on the basis of a joint venture. I shall elaborate on this point later in this chapter, as well as in subsequent chapters.

In order to overcome the above mentioned inherent constraints, four major policies should be considered:

1) Specific strategy of the single company in development, production and marketing.
2) Careful selection of the R&D areas according to local specific advantages.
3) National policy and government support incentives.
4) International cooperation.

THE SPECIFIC STRATEGY OF THE SMALL OR MEDIUM SIZE COMPANY IN A SMALL COUNTRY

One of the interesting cases for analysis is the advanced technology industrial company of moderate size which is willing to penetrate a market already captured by huge companies. The dream of such a company is usually to get some piece of the cake, say a few percent of the several billion dollar market.

Let us investigate the problem of the company of moderate size which plans to promote the product in a market in which huge companies compete. To ensure that such planning will succeed, the program manager, who in this case is really unfortunate as compared to his colleagues in big companies or countries, must analyze his chances carefully. His program should be based on two major factors:

1) Recognizing the advantages of small companies over large ones and suppressing the relative disadvantages.
2) Careful analysis of the whole program from development to marketing and implementing possible advantages to cut time schedules and decrease expenditure budgets.

Small or moderate size companies, may have much more flexibility either on the organizational or technical levels. The advantage of quick response can be profitably utilized at different phases of the project. Cooperation between different groups involved in the project, and the process of transferring knowhow within the plant from group to group, according to the phase of the program, is much simpler to achieve than in big companies. It enables quicker feedback from prototype testing back to the designers, and from field evaluation back to production. Such cooperation is essential to a flexible and dynamic organization.

On the other hand, the company should as much as possible, try to suppress the influence of its own inherent disadvantages. For instance, the necessity to concentrate effort is much more vital in small companies than in big ones. Only companies experienced in R&D know how important it

is to concentrate effort at the phase of production and marketing. Thus efforts should be expended either in selecting carefully the order of projects developed simultaneously in the plant, or in which sequence to start projects.

Another essential limitation is the development of new technologies. For a small company it may be almost prohibitive to develop products based on unproven new technologies. Failure in R&D projects may be fatal for the company. Such limitation will dictate a strategy of transferring technologies to the plant rather than developing them, and basing the new product on new concepts and on the integration of proven technologies.

CAREFUL SELECTION OF R&D AREAS ACCORDING TO LOCAL RELATIVE ADVANTAGES.

Israel has during the years of its existence concentrated on a few industrial areas linked to its special needs, such as the need for a guaranteed supply of elaborate defense needs, the need for water, energy, etc. In other words, security problems, the lack of natural resources, and Israel's strong drive towards economic and political independence have played a crucial role in the development of Israeli industry, and the direction it took. Therefore, we find that Israel has shifted its effort to develop special industrial areas, which could partially solve her unique problems. In this category one might find the typically military oriented branches, such as aircraft, missiles, and communication industries on one hand, and on the other hand, systems typical in civilian areas such as agrotechnology, irrigation, chemicals, pharmaceuticals, solar energy, etc. In fact, Israel has taken a world leadership in some of these areas. The development of the above mentioned industrial branches has served as a basis for the newly founded innovative industries. The military industry inspired the formation of civilian telecommunication, computers and many other areas.

Since the mid-seventies, a whole range of new industries has been established. Here is a list of areas and typical related projects:

Solar energy and energy conservation	Industrial and home solar collectors, solar ponds and use of waste heat, solar heating and steam generation, food dehydration using solar energy; photovoltaic cells; motor vehicle transmission; water desalination.
Bioengineering, medical instrumentation	Tomographs, various CAT devices, nuclear medicine, heart monitors, pacemakers, artificial kidneys, pain relievers, footprint and cold device.

Agrotechnology	Biological control of crop destroying insects, pesticides, computerized irrigation equipment, industrial agricultural machinery, uses of agricultural waste.
CAD/CAM, computers, software	Robotics (tool machines, metal industry), jewel processing, electro-optical sensors for printed circuits, software for office management, communications, financial management, design, etc.
Biotechnology, genetic engineering	Interferon, vaccines for cattle diseases, growing hormones for animals, anti-malaria germs, human growth hormones, new process for shrimp growing, development of bacterial and yeast strains for chemical and pharmaceutical products, diagnostic kits.
Pharmaceuticals	Anti-cancer drug, Pheromones, THF.
Communications	Talk doubler, rural monitor telephone system
Lasers	Medical lasers, high power lasers, military lasers, laser printers.
Food	Artificial sweeteners, sweet and salty water algae.

NATIONAL POLICY AND GOVERNMENT SUPPORT INCENTIVES

It is the purpose of this section to give an overview of government support incentives and activities, and the rationale for this policy. These supports will be described in great detail in the following four chapters: The next chapter will be devoted to a description of the direct financial support, the criteria for project approval, the principles of operation of the program, etc. Two subsequent chapters will describe the infrastructure for R&D: The financing of pre-industrial research at universities, as well as other types of support given to academic institutions; another chapter will describe the network of industrial research institutes established with government support, and the kind of services and facilities they offer. Finally a chapter will be devoted to tax incentives, tax shelters, limited partnerships and venture capital.

The government of Israel is aware of the fact that because of its small size which makes a small market, and because of its [illegible] geopolitical situation, R&T projects could be riskier than anywhere else.

Add to that the permanent lack of capital, especially risk capital, and the distance from world markets, and you may find that the establishment of a science-based industry in Israel is something close to impossible without massive government support.

The main purpose of government support of industrial research and development in Israel is to increase exports through establishing science based industry, so as to shift the weight from traditional capital-based industry to innovative industry. Additional goals were the encouragement of a shift of manpower from the academic institutions to industry, encouraging industrial research at universities, and the absorption of immigrants.

The assistance given to the science based industry is based on a system of incentives intended to encourage industrialists to participate in R&D ventures. Government participation in such ventures significantly reduces the risks and gives the projects involved a sense of reliability. The government does not interfere in any way whatsoever in the actual process of running the R&D projects. The management of the R&D program is completely free to choose the method it prefers to execute the plan (once it is approved by the OCS). In this way, the advantages of private enterprise are untouched, and yet the project enjoys strong governmental backing. The OCS which is in charge of the financing of industrial R&D projects is notwithstanding keeping an eye on every stage of the development of the project it supports. The OCS tries to be discriminating in its choice of the various projects, so that its support will be given to the most promising.

To implement government policy, the Office of the Chief Scientist through its research fund usually finances half of the cost of R&D projects aimed at export, after they have been approved by the Research Committee headed by the Chief Scientist. For new start-ups a larger percentage may be considered, up to 2/3 of R&D expenses. Projects for the improvement or upgrading of existing products and processes aimed for export (as opposed to truly innovative projects), usually receive about 30% of their approved budget.

Another component in the government encouragement system for science based industry is the creation of suitable physical infrastructure. This element gives the industry (and especially new start-ups), an opportunity to locate in special areas which are close to scientific research and technological centers. These industrial parks include modern buildings with necessary equipment for such an industry, all in close proximity with the leading academic institutions of Israel, which can be rented to companies at a reasonable fee.

Far more important is the government contribution to the creation of a professional and technological infrastructure from which industry can draw its ideas and manpower needed for industrial R&D. OCS supports pre-industrial research at universities through joint funds with those institutions. The funds are designated for the examination of ideas of senior academic personnel, by supporting pre industrial researches. In

relatively small scale and limited period of time. All such research is intended for the development of a product or a process which is suitable for exploitation by the local industry, but still not mature enough for direct support by it. The main purpose of these funds is to fill the shelves with new projects for the industry as well as investors. There is also a different set of incentives to encourage industry to subcontract work at academic institutions.

The OCS is connected with some 12 research institutes in different industrial branches. The institutes deal with industrial R&D and give service to industry. These institutes very in their legal status and their level of government involvement. The OCS supports all these institutes in their local budget, treats them as an infrastructure of the industry, and they are used as a basis for research activities. The OCS is represented in the management of the institutes and controls the budget, the manpower and the work program. The goal is that close relations will be created with industry, while part of the budget of these institutes will come from research projects commissioned by industry. The direct OCS contribution is used as a technological infrastructure. Therefore the OCS encourages maximum involvement of industry in these institutes, including participation in their management.

INTERNATIONAL COOPERATION

Israel's R&D potential is clearly greater than its ability to exploit its own innovation. The limited size of Israel's economy (population 4 million, GNP 34 billion dollars) is obviously not large enough to justify large scale investment in production equipment for making products based on Israeli innovations. Our potential markets in contiguous areas are still closed to us for the most part (with the exception of Egypt which is only normalizing its relationship) and our ability to market to Europe, Asia, Africa and the Americas, is limited by the cost of transports, of setting up marketing organizations and maintaining stock abroad. The government therefore encourages foreign companies to participate in industrial R&D ventures, offering them a fair share of the market in their geographical areas. This policy is based on the experience that a company in America or Europe which has taken part in production development will be more likely to promote its sale.

There are several ways for foreign companies to enter joint ventures:

1) Establishment of subsidiaries to develop and produce new products based on Israeli technology.
2) Joint projects with existing Israeli firms for mutual benefit.
3) Marketing agreements in return for investments in R&D projects.
4) Limited partnerships in innovative projects and companies.

In order to increase the momentum of foreign investments through limited partnerships, the government has decided to grant loans to investors on very easy terms. These investments, including the loans, can be used under certain conditions as [illegible] under U.S. laws f

detailed description of the principles of operation of this program will be given in great detail in a subsequent chapter.

In order to further promote international cooperation in industrial research and development, the Government of Israel has signed agreements of cooperation with five foreign governments. By far the largest program is the one signed with the U.S. government which led to the establishment of the Binational Industrial Research and Development Foundation. Since Israel has been to a great extent a pioneer in this type of cooperation, it is my intention to describe in great detail the various agreements, and to devote several chapters to the various aspects of these programs: criteria for project approval, funding agreements, cooperation agreements, budgeting problems, lists of projects, matchmaking, royalties, etc.

DIRECT FINANCIAL SUPPORT

As I have previously mentioned, the Government of Israel has decided to support industrial R&D in order to increase the export of technologically sophisticated products. In order to qualify for direct financial support, the R&D must lead to innovative results.

The results of the R&D can be considered innovative, as long as they are not part of the present State of the Art. We define State of the Art as any know-how related to the specific discipline involved which is available to the general public anywhere in the world, or in a specific country, either in writing, or as common knowledge, or in any other way.

The R&D project is considered innovative, if the results are not self evident from the available know-how, namely that the solution will not be readily available to any technically or scientifically qualified person who tries to solve a specific problem. In order to qualify as R&D, the project must have at least one of the following objectives:

1. The generation of new knowledge as a result of a well planned program involving innovative steps.

2. The application of existing knowledge to the problem of generation of new products, including the effort involved in testing various applications for new products or processes.

3. The application of existing knowledge to upgrade existing products or processes. (In this case the financial support will be at a reduced rate).

It must be emphasized that routine activities do not qualify as R&D; each step in an R&D project has the main objective to add knowledge, or to improve or bring innovative changes in a product or a process. Therefore, a whole line of activities cannot be considered as part of the R&D project: Market surveys, administrative or legal steps involved in patent application, quality control, the testing and the revision of various products and processes in the plant, trouble shooting, technical services to the various production and sales units, routine data collection etc. In the case of literature surveys and visits to professional congresses and exhibitions, it has to be proved that the knowledge thus acquired is specific to the relevant R&D project and not a routine activity.

In other words, in each and every project two main questions will be asked:

1. What are the scientific and technological problems that require an original solution, or what are the innovative results expected?

2. What is the risk that no satisfactory original solution will be found to those problems? (In other words to what extent is the project truly innovative, and the hoped for results not self-evident).

If the project is considered innovative, it must satisfy a set of criteria before it qualifies for direct financial support:

1. THE PRODUCT IS INTENDED FOR EXPORT.

The objective of the program must be the development of new products intended for export. This does not mean that the developer must start exporting immediately. Often the new product starts by being marketed locally, mainly in order to obtain some initial feedback. However it must be remembered that the final objective is the export of a considerable share of the production. The total expected volume of export sales must be far greater than the investment in R&D.

2. TECHNOLOGICAL FEASIBILITY.

The proposer must prove to our satisfaction that the program is technologically feasible, economical in its use of resources, and that it has a high probability of achieving the hoped for technological objectives. Among other things, the proposer must provide plenty of scientific and technological data on which the program is based. For example, in the case of a solar collector being developed, the data submitted will be in materials science, thermodynamics, etc.

3. ECONOMIC FEASIBILITY.

It must always be remembered that the R&D project is a first step in a process in which the final objective is the manufacture and export of a new product. The proposer must therefore prove to our satisfaction that the new product has a sizable potential market, and explain why his product has a reasonable chance to penetrate that market as a result of its specific advantages. The program must therefore include a marketing strategy, and should include a description of the means to achieve the marketing objectives.

4. TECHNOLOGICAL AND MANAGERIAL POTENTIAL.

The proposer must show that he has at his disposal a well qualified scientific and technological team that can carry out the R&D program. It is desirable that at least some members of the team will have R&D experience. The team must be headed by a well qualified manager who can provide the proper scientific and technological leadership.

5. PRODUCTION AND FINANCIAL POTENTIAL.

The applying enterprise must show how it is prepared, (or how it will be prepared in the future), in order to manufacture the product which will hopefully be developed. This should include a description of the means of production (facilities, equipment, manpower), the possibility of using subcontractors for part of production, etc. The applying enterprise must also show that it possesses the financial capability to finance its share in the R&D project, as well as the production and marketing efforts in the more distant future.

In order to start the process that may lead to direct financial support, the proposer must fill out a long and complicated application form. This is a very sophisticated form, readily adapted to a system,

and I would like to dwell in some detail on the various data required of the applier, as well as problems involved, recognized expenses, etc.

The proposer starts by supplying a general profile of the company: name, main products, manpower, sales, export; a more detailed description of the main research personnel (including personal history), a full report about previous R&D projects. Of course, if the proposer is a new start-up it should state so.

After that, the proposer states the name of the project, and gives a short abstract of the technological objectives and economical aspects of the project. This is followed by a Grant Diagram outlining the various stages of the project, and the amount of manpower involved in each step. Here it should be mentioned that for budgetary considerations, the allocation of government funds (if any) is contracted on a yearly basis; nevertheless we require a complete description of the program, even if it is projected over several years. After that we arrive at the all important problem of the budget and recognized expenses.

Even stating the figure of the total budget becomes a problem in Israel: for the past few years, Israel has "enjoyed" an inflation rate of 150-400% per year. The salary of the employees is indexed, and usually goes up every three months or so. Accordingly, most other expenses go up as well, at a fairly unpredictable rate. Under the circumstances, it is very difficult to give a definite figure for the yearly budget, let alone for a period of several years. Nevertheless, we require a total budget figure for the first year, and the proposer must state the inflation rate that he is projecting. This is usually modified according to our own projections (or those imposed by the Treasury), and we finally arrive at a more or less reasonable figure.

We divide the budget of each projects into five categories: Materials, salaries and overhead, subcontracting, equipment, miscellaneous.

1. EXPANDABLE MATERIALS.

As a rule we recognize all materials and components required for the R&D, including the construction of industrial prototypes. Usually, only one industrial prototype is approved, unless we are thoroughly convinced that additional prototypes are required. Whole systems required for the prototype will also be recognized, unless they constitute multi-purpose systems (like computers or display screens), which can be readily converted to other uses.

Materials and components should be listed in categories, which can be readily identified and studied by experts, with very high-priced items separately listed. Only such equipment which cannot be put to other uses after the project is over, may be listed (for example in the case of glass laboratory equipment, only a certain percentage of breakage will be allowed).

2. SALARY AND OVERHEAD.

Only such employees that are directly involved in the R&D project itself will be recognized. This will include scientists, engineers, technicians and workers. Secreterial help, maintenance and cleaning workers, accountants, etc. are included in the overhead. Economists and marketing personnel can be included, only if it is proven that they have taken an active part in a preliminary survey indicating the necessity of the product, or in the technical specification of the product.

A full time employee will be recognized, provided he is employed only by the company engaged in this project. Such an employee cannot provide his services to another company under any circumstances, and the proposer has a duty to inform us concerning the employment of their workers by other companies. Full time Professors at one of the recognized Universities can be employed up to a maximum of 33% of their time. The Chief Executive Officer of the company can be a part of the R&D project on a part time basis only, provided he really devotes a considerable amount of his time to the project, and reports like any other employee.

The salary debited to the project will include salary and expenses (such as car and travel allowance, telephone, professional literature, etc.). Social benefits cannot exceed 33.3%, a figure imposed by the Treasury, which is considered low by experts. Another figure imposed by the Treasury is 80% overhead (many companies claim 54% social benefits, and over 50% overhead), so these figures have produced endless complaints. However, when all is said and done, these low figures enable us to finance a larger number of projects within a given budget.

3. SUBCONTRACTING.

There are several possibilities for work by subcontractors:

1. A subcontractor performing part of the R&D project.

2. A subcontractor performing a specific scientific task - e.g. toxicological testing involved in developing a new medicine - which serves the R&D group in the company, but does not constitute R&D work as such.

3. Subcontractors performing a specific contracted job, e.g. building models or prototypes, development of software, installation within the pilot plant, industrial design, etc.

4. A scientist or an engineer serving as a consultant to the project. Usually his job will be to evaluate the achievement of the project so far, and to advise about the following stages. A company can also serve as a consultant.

In all such cases the company will give the budget for the subcontractor according to all the rules of the budgeting (including such restrictions as social benefits or overhead). Special mention should be made in case the subcontractor is an academic institution, or in cases where the subcontractor is paid in royalties.

4. EQUIPMENT

The cost of equipment can be budgeted only under the following conditions:

1. The equipment will be used only for the R&D project. (namely it will not be used for production, or other purposes).

2. The equipment is specific to the project, and is not routine equipment that is usually a part of a research laboratory.

3. The equipment has been approved as necessary to the project.

Such equipment items can be budgeted in foreign currency. Only 20% of equipment expenses will be recognized for each year of the project, the philosophy behind that being that only amortisation costs can be approved. In very rare cases, when the company can prove that the equipment is of no use whatsoever once the project is finished, will 100% of equipment costs be approved.

5. MISCELLANEOUS.

Under this category only the following items, which do not belong to another category, can be included.

1. Preliminary market survey. This is understood to mean the work performed by the company in order to technically specify the objective of the project, and thus help direct the R&D work. Any survey that does not meet this very narrow definition will not be recognized.

2. Patent registration. The costs of patent registration, including legal fees, will be approved only for the products developed within the R&D project. This will include registration fees in Israel, and in a limited number of foreign countries, and have to be incurred during the duration of the project.

3. Travel in Israel will be recognized only if the R&D project is carried out in various facilities, considerably distant from each other. The per diem will be that of senior government officials.

4. Renting or leasing of equipment will be recognized under the conditions described above.

5. Computer time will be recognized only in the case of real expenses which can be readily identified (rather than cost accounting).

6. Travel abroad. As a rule such expenses will not be recognized, since we view travel abroad with deep suspicion. Nevertheless, in very special cases, when travel is of utmost importance to the R&D project a limited number of trips may be approved. A special application must be made for each trip. The recognized expenses will be up to the level of those of senior government officials.

The application form must include an all-important appendix that describes the scientific, technological and economic background of the whole project in greater detail that can be reflected in answering the various questions in the application form.

TECHNOLOGICAL AND SCIENTIFIC BACKGROUND.

1. This should start with a full description of the final product that is to be marketed once the innovation process is completed. The description should relate to the following questions:

What are the uses of this product?

What is the performance of this product?

What is the range of the product?

How does it work?

A general external description (dimensions, etc.)

(If it is a process rather than a product, a similarly detailed description is in order). If this is a continuation project, a detailed description of the achievements in stage A must be included.

2. The product to be developed in this project, must provide the solution to a specific problem (Otherwise there is no justification for the whole project). The question is, how is that problem solved today? (Possibly, there is no present solution).

Considering the present State of the Art (or the substitute products available), one must justify the development of the new product, and why there is a good chance it will penetrate the market. In principle, a new product can penetrate the market provided there is a high ratio of performance vs. price, as compared to what is available today. One must explain within this paragraph the technological advantages that will help the new product penetrate the world market.

3. Research and Development is essentially a process involving the solution of technological problems. The proposer must elaborate the problems he expects to encounter during the R&D process, and how he hopes to solve them.

4. While paragraph (1) gave a general description of the product, this paragraph should describe the main scientific principles on which this product is based. A simple drawing should be helpful.

MARKETING AND ECONOMIC BACKGROUND.

The technical specification of the product must aim at a very specific segment of the market. One should mention who are the potential customers of this product.

The proposer must give his forecast of sales in foreign countries. The names of these countries should be included. We feel that in the development stage, one should have a very clear idea where the target markets are. This should help define the product.

The following questions must be answered for each of the target countries, mentioning the source of the data.

1. An estimate of the sales in this field. This be must obtained through the professional literature, or through marketing research agencies. In the case no accurate information exists, an estimate should be provided (e.g. 10-20 million dollars).

2. The developing company will have to compete against other companies that are already active in that market. It is necessary to gather as much information as possible concerning the potential competitors. This will give a general picture of the market, and make possible marker strategic planning. If possible, one should describe the strengths and the weaknesses of the competitors, and how those weaknesses can be used in order to penetrate the market.

3. The proposer should provide data concerning competitors' prices, and designate a target price for its product. One of the objectives of the R&D project is to plan a product in such a way, that the target price will cover the various costs, and leave a reasonable profit.

4. The proposer must describe in detail his marketing strategy. He must mention his marketing outlets (establishing subsidiaries in target countries, using local agents, etc.). If the proposer is a new company, he must describe in great detail his plans for the establishment of a marketing system. One must also define the marketing strategy, e.g.: we plan to occupy a niche in the market that is not profitable for other companies to enter.

5. Beside the marketing survey, one must also include a patent survey, in order to make sure there are no existing patents which will prevent or restrict production. A similar survey should be made with respect to various laws, standards and regulations.

In order to prevent a situation where the company has no resources in order to apply the results of the R&D project, one should describe in detail the sources of capital available after the project is completed in order to go into production and marketing. And finally one can include all other data that the proposer considers pertinent: Plans for manpower, production facilities, justification of the various stages of the R&D program, personal histories of key personnel, letters of intent from potential customers, etc.

After the application has been received and processed, the Chief Scientist appoints for each project a Professional Reviewer. This is a scientist or an engineer, usually at the Ph.D. level, who is well quali-

fied technically to review a given project in his or her specific field. Usually this person belongs to the Ministry of Industry and Trade, although at times people from academic institutions or other ministries (e.g. Ministry of Telecommunications) may be used. All of them sign a pledge of complete secrecy.

The reviewer reads carefully the application and all its appendices, and then meets with key personnel in the appying company. In many cases he may use other sources of information, such as reports from companies specializing in providing information concerning the financial status of other companies, professional literature, computerized information centers, and last but not least, present or potential customers of the applying company. He may well want to discuss some scientific problems with known authorities in the field, but this will be done only after this has been coordinated with the applying company, and an appropriate pledge of secrecy is obtained.

The reviewer will finally submit a written report which includes all the aspects of the project: The product to be developed, the R&D process, the innovation involved, a profile of the company, its financial and production potential, its R&D capabilities, past record in industrial R&D, marketing strategy and potential, budget considerations, in short he must address almost every one of the aspects already described. Finally he makes a recommendation, and the application together with his report and recommendations are brought before the Research Committee.

The Research Committee is a body prescribed by the Encouragement of Industrial Research and Development Law (1984). The chairman of the committee is the Chief Scientist ex officio, and there are four additional representatives of the Ministry of Industry and Trade, appointed by the Minister of Industry and Trade, two representatives of the Ministry of Finance appointed by the Minister of Finance, and three public representatives, jointly appointed by the two Ministers. The main function of the Research Committee is "to decide upon the approval of projects (...) within the framework of the State Budget".

(It is worth mentioning that the above mentioned law was passed by the Knesset a year ago, after several years of deliberations in committees. One of the main fights was by a powerful industrial lobby, that insisted that all projects that meet the criteria in the Law have to be approved and financially supported. The Ministry of Finance insisted that a limit must be imposed, and insisted upon the words "within the framework of the State Budget". As usual, they won.)

The committe meets once a week, usually on Tuesday mornings, and reviews 20-30 projects during each session. The Professional Reviewer describes the project in some detail, and presents his recommendations. The committee members ask a lot of questions, usually about the innovation involved, the economic and technological feasibility, and about the company. A lively discussion follows, and beside the above mentioned criteria, there are several other factors that affect the committee decisions:

1.Usually there is at least one committee member familiar with the company involved, or with the subject matter of the project. A very favorable or very poor report on the past performance of that company has a great influence on the decision. There are also cases when a committee member says that the project has been tried elsewhere without success, or that the technology has already been developed, and it is a case of reinventing the wheel.

2. There are some general groups of projects that the committee is wary of. For instance it is known that the introduction of a new drug would cost 50-100 million dollars which is beyond the capability of most Israeli companies, so even very promising projects are viewed with great suspicion. Projects involving consumer products get the same treatment for similar reasons. The same goes for projects in fields where there is no existing Israeli industry - e.g. nuclear energy, automotive industry, etc. Market trends are taken into account, e.g. the world market for insecticides was very good 5-10 years ago, and has lately declined.

3.There is always the problem of the new start-up company. It is far easier to deal with large, experienced, well-established companies. They know what is expected of them, they are familiar with our definitions of innovation and techno-economical feasibility, and their application forms are a joy to read. What is even more important, they have a proven track record, and you can be reasonably certain that if the project is successful, they will be able to produce and market their product. The new start-ups submit poorly written proposals, and have shaky financing and little or no experience in production and marketing. On the other hand, the large companies will engage in industrial R&D even without government support, while the small company will wither and die without us. It also turns out that some of the leading exporters of technologically sophisticated products, were new start-ups 10-15 years ago, and would have withered without our support. We must therefore make every effort to weed out the poor risks, and encourage the truly innovative small company.

4. Despite all our definitions and criteria, there is no sharp dividing line between innovation on one hand, and engineering or upgrading on the other hand. While most approved projects receive a support of 50% of recognized expenses, we would support 30% of expenses in projects where the innovation element is not that great (sometimes parts of the same project will be financed at 50%, other parts at 30%). Likewise we shall finance 30% of a project where the product is an import substitute rather than a true export item.

5. And finally there is the eternal question whether we should be a passive or an active organization. In other words, should we go out and tell companies, go ahead and do research in that field, and stay away from another field, or lean back and accept and judge applications on their respective merits. By and large we are a passive organization, mainly because we do not think government officials are smart enough to tell companies how to run their business. Nevertheless, we encourage companies in R&D poor industries (textiles, food) or in very trendy industries (genetic engineering, software) to submit applications. There are some fields we consider saturated by research (solar collectors, computerized

irrigation with very little chance of innovation (and very little risk in the project), so we treat those projects with some suspicion.

After the committee meeting has ended, decisions made and the minutes have been approved and signed by the Chief Scientist, a contract is signed with each company whose project has been approved. This is a long and complicated contract that obligates the government to bear 50% (or 30%) of approved project expenses, while the company is obligated to carry out the approved program, make financial and technical reports, and a lot of other things that to the non-legal mind seem obvious. There are however two very important additional provisions:

1. The product developed in this project must be manufactured in Israel. The philosophy behind this is that the taxpayers' money must be spent in order to increase the exports from Israel (thus improving the foreign trade balance) and to provide employment opportunities for Israeli workers. In many cases it is more profitable for a company to sell know-how rather than go into production. Since we are a free country, any company can do that, but since we feel that it does not serve the national interest, we are not going to support financially such projects. There is the possibility of production abroad with the written permission of the Chief Scientist. This permission is given only in cases where the company starts production in Israel and wants additional production facilities elsewhere. In rare cases, when production in Israel proves impossible, the permission is reluctantly given, only after the taxpayers get their money back with interest.

2. If the project is a failure, the government financial support becomes a grant. If the project is a technological and marketing success, the government wants 3% of sales until the original grant is returned (indexed for inflation, but with no interest). In other words, we never make a profit, all we want is our money back; but it seems companies are far more eager to receive money than to give it back, and we are having great difficulties in enforcing this paragraph. There are endless ways the companies try to evade paying back our grant, and we try to fight them as well as we can: we send auditors, we do not consider new applications from companies who owe us money, and we do not approve new projects in the case of companies with a poor track record (namely companies that keep reporting that their projects have failed, in order to evade paying us royalties). Despite all our efforts, we have had only limited success collecting.

Nevertheless, one must always keep in mind that the main objective of this program is to increase exports (as well as several other objectives previously mentioned). Since most of these objectives have been attained (the most important was the dramatic increase in the export of innovative products previously described), the program must be considered a roaring success.

INFRASTRUCTURE AT UNIVERSITIES AND RESEARCH INSTITUTES.

All industry, especially innovative industry, must be continually in the process of change, growth, development and regeneration. Therefore, it is necessary to have a technological and professional infrastructure that supports these processes efficiently. In order to make sure that these changes occur smoothly and naturally, all the relevant details of the infrastructure must be planned and developed in advance.

For that purpose, the Office of the Chief Scientist has set aside a special "infrastructure fund" in order to finance infrastructure activities at Universities and Industrial Research Institutes. In principle we recognize as infrastructure all activities contributing to technological industrial innovation, but which industry itself is not prepared to perform, either because of lack of funds, or as a matter of priorities. Often we will recognize a project as an infrastructure activity if it contributes know-how to a number of companies in one or more sectors concerning one or more components in the scientific-technological inventory; a factor to be considered is if an obvious saving of national resources is expected, whether financial or human.

Because of the special nature of infrastructure activity, we finance the complete cost of such activities (rather than the 50% financing of projects carried out by industrial companies). For these same reasons, work of this type is done at institutions of higher learning, public or government research centers, or other groups which usually are not part of any industrial enterprise.

The following is a list of the various ways the industrial infrastructure is being developed through projects supported by the Office of the Chief Scientist, in cooperation with appropriate bodies:

1. Development of a technological infrastructure for a branch of industry, usually in the form of a center possessing technological equipment and the appropriate know-how in a specific field. Companies can take advantage of such centers, by contracting for research, tests, consultations and current information.

The following example will illustrate this principle: The jewelry industry in Israel, while exporting handsomely, was felt to be technologically backward, and therefore not living up to its full potential. Few if any engineers and scientists were employed, even though there are a number of scientific and technical problems involved in the production of jewelry. We decided to form a Center for Noble Metals, and for two years we financed completely all of its activities, which consisted mainly of acquiring equipment, know-how and experience. Soon industrial companies realized the importance of that activity, and started commissioning R&D projects, testing, trouble shooting, etc. Today the Center is self supporting, although of course we finance at 50% the R&D projects that meet our criteria.

2. Industrial Portfolios - Researchers at institutions of higher education who have ideas for industrial developments, which are likely to

be accepted by industry, are encouraged to develop a detailed proposal with the help of an "Industrial Portfolio Grant". The purpose of this Portfolio is to provide potential industrial companies with all the existing information, State of the Art, and if necessary, preliminary experiments, in order to persuade industry of the merits of the idea. These are small grants, covering 3 months salary and some additional means needed to prepare such a file.

3. Research projects involving future technologies likely to be adopted by industrial firms at a later date. Thus the Haifa Institute of Technology started studying in the seventies a technology called High Temperature Isostatic Pressure (HIP). Engineers and scientists from leading metal working companies studied the new technology, and many acquired the equipment and applied it in their own plants. The Hebrew University at Jerusalem started studying (with our help) MOS - LSI technologies, and the availability of local expertise in this field has attracted several leading American companies to set up shop in Israel. The Ceramics Institute is studying zirconium ceramics, which will probably soon be introduced by a leading Israeli company, etc.

4. Development of natural resources as raw materials for industry. It is felt that it is the national duty of the government to help exploit the country's natural resources, and the initial projects in this field are considered to be infrastructure activity. This includes techno-economic appraisals of deposits, and the study of the technologies of exploitation of such materials.

5. Techno-economic studies intended to help define our own aid policies, are also included in the infrastructure activity. These reviews are on topics in innovative technology and its limitations, manpower needs and its planning, lessons drawn from past activities and from the experiences of other companies and countries.

However the contribution of the Universities and the Industrial Research Institutes was not restricted to the above mentioned categories. As industrial R&D kept expanding rapidly during the last decade, the Office of the Chief Scientist encouraged and financially supported a wide variety of additional activities which will be described in some detail.

UNIVERSITIES.

Historically the universities employed the very best Israeli scientists and research workers. Indeed, for a country of its size, Israel has an extraordinarily high number of academic personnel, and far leads the world in the number of scientific papers published per capita. However, for years this wealth of scientific potential failed to make any impact on Israeli economy. Few if any university professors engaged in industrial R&D, first because there was no one to commission such work, but mainly since the "publish or perish" mentality is well and alive in Israeli universities, few members of the academic staff wanted to undertake work whose results cannot be published. Indeed until recently, industrial R&D was considered the ugly duckling of academic research.

Not any longer. The availability of research funds for industrial R&D, and the budgetary constraints affecting other types of research, has turned many talented research workers from pure science to applied technological and scientific research. They found the work interesting, challenging and sometimes personally profitable.

The most obvious way in which universities could help industrial R&D, was by serving as subcontractors in R&D projects approved by our Office. The fact that even industrial firms lacking R&D facilities could benefit from R&D grants was an incentive for industry to turn to universities' services (in addition, of course, to the industrial research institutes). The universities on their part started encouraging faculty members as well as graduate students to serve industry, and the high caliber research staff and modern equipment was an attraction even for firms with R&D facilities.

It should be mentioned here that despite the dramatic increase in subcontracting industrial R&D work to Universities, the marriage was not a happy one in all cases, and a deep mistrust exists between industrialists and professors. Indeed in a poll conducted by our Office, most industrialists have stated that given the choice, they would rather work without the help of university personnel. They mentioned a long list of complaints: They did not feel the company interests were the prime objective, the failure to stick to a schedule and to produce results on time, the failure to keep regular hours, a lax attitude towards secrecy. The scientists had a list of their own as to why industrial R&D is unattractive: The freedom to choose a favorite subject of research, the freedom in conducting the project as they choose, the freedom to publish and thus enhance their academic standing, regular working hours, access to sabbaticals, professional conferences, free exchange of information. Despite all that, real difficulties cropped up only in a minority of cases, and many successful projects were concluded to the mutual satisfaction of industry and academe.

But the real contribution of the academic world could not be in subcontracting work, which really means working on the ideas of other people. Many prominent professors and scientists, spurred by the new winds of industrial research blowing through their institutions, had original ideas of their own, that they felt that may lead to innovative, commercially attractive products, and ought to be investigated. When they brought such ideas to our Office, our first reaction would be to send them over to industry, and if an industrial company felt this is a good project, and was willing to finance 50%, we would provide the other half, provided the project meets our criteria. (It should be mentioned that in such cases the industrial company will make the application, they will be the ones who sign the contract, and the professor or his university will appear as subcontractors, even though they may be doing most or all the work). More often than not, the scientist would come back to our Office, bitterly complaining about the shortsighted industry who fails to see the genius of his work. He would beg us to support his research (at 100%) for a year or two, and then when the relevant industry will see the preliminary results, they will be sure to come in.

In some cases, when the project looked very attractive, we tried to accomodate them with our "infrastructure funds". Yet those funds are woefully small, and they constitute 2-3% of the funds allocated to industry. Our Ministry is equally suspicious of Universities, and I have often heard my superiors say: We are the Ministry of Industry, and it is not our job to augment the budget of Universities; let them go to the Ministry of Education. The result of this policy is that only a tiny proportion of that kind of projects could be funded, and in order to finance pre-industrial research on an appreciable scale, we had to look for other solutions. This led to the establishment of the "joint funds".

JOINT FUNDS.

Historically, the Joint Funds were the initiative of the Weizmann Institute, one of our leading institutions of higher learning. The Weizmann Institute, like most other universities, has a subsidiary company (called Yeda) whose main objective is the commercialization of the various new products and processes developed at the Institute. Yeda generates a small profit from patents and royalties, and according to its charter turns that profit over to the Weizmann Institute, where it forms a drop in the bucket of its total budget.

The director of Yeda at that time came to our Office and suguested that its profit be used to establish a fund to support pre-industrial research, on the condition that we provide matching funds. After endless negotiations, the Treasury agreed to that arrangement. (They rightly wanted to make sure that Yeda provided money it had earned, and not Weizmann Institute funds which are heavily subsidized by the government, and that would mean that the government is matching its own funds). The Ministry of Industry, recognizing the importance of pre-industrial research, agreed to recognize Yeda (and similar companies) as industrial companies for the purpose of industrial R&D, and thus open the way for direct financial support, and the Joint Fund was on its way. In the seven years that passed since then, four more such Joint Funds were established with other universities, so I shall describe them in some detail.

Each Joint Fund has its own Board of Directors composed of two representatives from the sponsoring university, two from our Ministry, and three public representatives. It has also an executive committee, which gives the applications a preliminary review, and after that, it directs the proposal for professional evaluation, both at the Weizmann Institute for example, and at the Office of the Chief Scientist. The criteria for approval are the following:

1. First of all the project must be product oriented. We do not support research into the mechanism of reactions or measurement of properties, unless a very definite new product (or process) can be identified as the final objective of the project. All projects titled "A new method for..." fill us with suspicion. Again and again we ask "What are you going to manufacture and sell if the project is successful?" After that, come all the criteria of innovation, export, etc. which have been described in detail in the previous chapter.

2. It must be understood that the final objective of the project is production in Israel. We often ask the question: "Suppose the project is a success, who is going to do the manufacturing?" If the researcher can name potential companies, we send him to talk the project over with them. If the company is interested in principle, we demand a non obligatory letter of intent, saying that the company will closely follow the project, and if the results are favorable, they will consider picking up the project. Such a letter greatly increases the chances for project approval. If the researcher cannot name potential companies, we make our recommendations. This process greatly enhances the interaction between industry and universities.

A project approved in the Joint Fund is considered a success if after a year or two it is picked up by industry. By "picked up" I do not mean production and marketing. I mean that an industrial company is willing to pay 50% of the costs of the R&D necessary to complete the project. This is utmost in our minds when we approve projects. If a project comes for renewal after 3 years, we ask very hard questions as to why no industrial firm has picked it up. A third year of research in a Joint Fund is almost unheard of. When faced with a very fine project in biotechnology with promising results in treating cancer, we ask drug companies if they might be interested, and if not, the project is dropped. Again and again we have to remind people that we are the Ministry of Industry, and not Health, Agriculture or Energy.

The budgeting of these projects is very simple, we usually allocate $40,000 per project. The reason is that the professor who brings the idea for the project already receives full salary from his university. The reason he needs money for the project is, that he is a busy person, with no time to do the actual detailed work. The necessary equipment is also usually available. What the money is needed for is to hire a junior scientist or technician to do the actual work. This costs in Israel some $30,000, including overhead. The balance is needed for operations (chemicals, computer time, workshop time, etc.). The professor can receive a supplement of up to 33% of his salary as a consultant to the project, but his real incentive (beside his scientific interest) is potential royalties if the project proves successful.

The Joint Funds can be considered a success: They increase the interaction between industry and universities, and enable many capable research workers to perform useful industrial R&D work. They help fill up the shelves with potential ideas and projects, ready to be picked up by established industrial companies, by companies willing and able to enter the high technology fields, and by investors. Indeed some 25% of the projects have already been picked up, and the scope of the program keeps expanding, limited only by budgetary constraints.

INDUSTRIAL CENTERS.

The interest generated by the expansion of industrial R&D in Israel has had its effect on almost every academic institution in the country.

Most Universities have singled out specific departments that are engaged in this type of research, and have asked the government to find ways to increase this type of activities.

OCS did help in establishing something called "Industrial Centers", but it was a little confused as to how to help them. What they really wanted was money, and OCS could not give them that, except under its own rules which have been described in detail above, and that they could get without the benefit of the Industrial Centers. Nevertheless it did try to help them ease the bureaucratic pains in subcontracting work, and helped them a little with meager funds from the "infrastructure fund". It also introduced two new ways to encourage industrial R&D activity:

1. When a specific technological discipline was concerned, OCS encouraged them to involve industrial representatives in the work of the center. Thus a Microelectronics Center was established at the Institute of Metals. The industrial companies involved pay $10,000 each every year as membership dues, and since that money came from industry, OCS could give matching funds. The representatives of the industrial firms involved meet regularly, and decided what to do with the money, if it is to be a project of general interest to the whole field, or the acquisition of equipment (this has of course to be approved by the OCS before matching funds are provided). This type of activity benefits industry as a whole, since they have a well equipped Center, with qualified personnel, to help them with trouble shooting, services, information, consulting, etc.

2. Very often it happens that industry would like to commission a small R&D project which would typically involve a few months work. The problem is that it takes several months from the moment a company applies to OCS, until they see the actual payment. Many companies avoid applying to OCS for such small projects. OCS now allows the Center to apply on behalf of a number of companies in what is called mini-projects. Thus the Centers that are chronically hungry for money, undertake all the considerable paper work, and accept many projects which otherwise would not come their way.

INDUSTRIAL R&D INSTITUTES.

In the early days of the State, when the government started realizing the importance of industrial R&D, it thought that the best solution to the problem would be the establishment of industrial R&D institutes. Thus the Fifties saw the establishment of the Israel Physics Laboratory, Israel Fibers Institute, Rubber Institute, Ceramic and Silicates Institute, and several others. It was hoped that various industrial companies that did not have R&D facilities (hardly any company did in those days), would commission R&D projects at those institutes. This was not the case, and indeed until the early seventies the economic impact of industrial R&D was nil. The reasons were that the companies did not realize the economic potential of industrial R&D, they did not receive direct financial support for that purpose, but the main reason was probably the deep mistrust of industrial companies for scientists in long white coats working in a far away laboratory. The result was that those institutes were conducting long

range research projects, of little if any interest to the industrial companies in the field they were supposed to serve, and with no tangible results which could readily be translated into exportable, innovative products. Financially, those institutes were totally, or almost totally dependent on the government.

When the Office of the Chief Scientist was established, and a policy of direct financial support was formulated and implemented, it quickly found out that the companies preferred to do their research "in house" rather than commission work to universities or institutes. Under a strict policy of "industry knows best" OCS encouraged them to do so, and were pleased to see industrial companies hiring scientists and engineers, setting up R&D laboratories, etc. As the volume of industrial R&D kept growing, some of the projects (or parts of projects) were subcontracted to those institutes, but this constitutes a small share of the total industrial R&D work carried out in the country.

The Office of the Chief Scientist turned to the Industrial R&D Institutes, and demanded that they earn their upkeep, that is to say, get industry to commission projects. At first those measures were very drastic, and there was a demand that the Institutes earn enough money to cover their entire budget. Under Israeli conditions this proved to be unrealistic. No Institute appears able to meet those demands, and survive entirely without some government support.

After a while, OCS accepted the fact that the government does have some responsibility to provide infrastructure to industrial R&D in the form of institutes, to perform long range research, etc. Today OCS regards the income structure of a "good" institute as follows: One third of the income should be direct government support (which will be elaborated later), one third must come from services to industry (testing, consulting, trouble shooting, information, etc.) and one third from commissioned industrial R&D projects.

Even those guidelines were somewhat difficult to follow: indeed OCS had to close down one major institute that could not even come near those standards, and many other institutes had to reduce their manpower and restrict their activities. But what is most important, this policy resulted in getting all Institute Directors out of their offices and into industrial companies, offering their services, trying to interest companies in R&D projects, and getting their staff to cook up projects which might be of interest to industrial companies. Under the principle of "industry knows best", when a company adopts an idea that has originated in an institute, and commissions a project, it is the company that makes the proposal, and the institute appears as a subcontractor, even though it may perform most or all of the work. In their eagerness for projects, the directors of the institutes often volunteer to write up the proposal and sign the company's name to it.

The direct government financial support (which usually constitutes a third of the institute's income) comes in two forms: part of it is direct support which appears in the Budget Book of the government, but it is

very small. Another larger part, is provided by OCS in the form of "infrastructure projects" (see above). Those are long range projects, financed at 100%, which involve technologies and principles which might beadopted by the respective industry in the more distant future. At the beginning of each year, every institute presents OCS with a detailed list of proposals for such projects. OCS picks the ones it feels would be most relevant to the specific industrial branch, and finances them accordingly. Since the establishment of the Joint Funds, universities no longer have access to the infrastructure fund, so OCS can use all that money to help the industrial R&D institutes.

It would be nice if I could say that the institutes were established according to a Master Plan, as they were needed. However, the truth is that most of them have a historic reason for their establishment, and some are more necessary than the others. Accordingly, there are also differences in the legal status and the degree of government involvement, between the various institutes. By and large, they can be divided into three categories:

1. Government Departments. All the employees are civil servants, and the director does not have to worry how to cover the next payroll. The government dislikes the idea of running research institutes, and would dearly like to get rid of them, but has trouble finding takers.

2. University and government. In principle, those are university departments, but since universities are chronically short of money, there is a constant demand for more support from the government. The board of directors is composed of government, university and industry representatives.

3. Industry and Government. Those are true industrial institutes, jointly established by the government and a specific industrial association. The board is composed of representatives from government and industry (who volunteer their time and energy as a public service). We usually insist that the industry representatives have a majority, and that the Chairman of the Board be a prominent industrial leader in that field. Nevertheless the government representatives are under constant attack for lack of sufficient financial support.

The following is a very brief general description of these institutes:

1. Israel Fibers Institute (Government Department). Fibers (natural and synthetic) and their various products, e.g. textiles, wood, leather and paper.

2. Institute for Applied Research in the Negev (University and Government). Chemistry (natural resources, ceramics, fine chemicals, production processes), agrotechnology, engineering (mechanical and electrical), biotechnology, laboratories and pilot plant services for industry.

3. Israel Physics Laboratory (Government Department). Physical standards, applied physics, electro-optics, solar energy, batteries, services to industry on energy conservation, recycling and ecology.

4. Israel Institute for Metals (University and Government). Development and improvement of metallurgic processes, research on the behavior of metals, casting processes, laboratory for noble metals and electroplating processes.

5. Institute of Ceramics and Silicates (Industry and Government). Ceramics, enamel, glass, cement and fireproof materials.

6.Fermentation Unit (University and Government). Microbiology, processes for production of biochemicals and enzymes for the food, chemistry and pharmaceutic industries.

7. Institute for Rubber Research (Industry and Government). Formulations, development and improvement of rubber products, information services.

8. Institute for Paint Research (Industry and Government). Paint technology and uses, development of new paints, corrosion problems.

9. Israel Institute of Plastics (Industry and Government). Services, research, trouble shooting and consultation for the plastic industry.

10. Israeli Company for Life Science (LSI Company and Government). Toxicological testing (GLP Standards) available to local industry, especially pharmaceuticals, chemical and food industry.

11. Institute for Science and Halacha (Public Agency). Modification of common equipment and industrial processes to comply with Halacha (Jewish Law and Tradition).

12. Israel Institute of Innovation (Public and Government). This institute studies patents, inventions and technological ideas of newcomers and local inventors, and tries to bring the worthy ones to production and commercialization.

TAX SHELTERS AND VENTURE CAPITAL.

As industrial R&D kept expanding, more and more resources were required for its implementation. The government budget is by its very nature limited, and not enough funds are always available for direct financial support. Since the economic benefits of industrial R&D were becoming more and more evident, the government decided upon a series of regulations intended to encourage Israeli and foreign investors to invest capital in industrial R&D. These regulations can be divided into three categories:

1. Tax shelters for Israeli investors.

2. Regulations intended to attract foreign investors (mainly from the U.S.) who can use the venture capital investment in Israeli industrial R&D as tax shelters in their own country.

3. Favored issues on the stock market.

TAX SHELTERS FOR ISRAELI INVESTORS.

In order to attract venture capital from public and private Israeli investors, the Internal Revenue Service published amendment #20 to the Income Tax Law, and I shall do my best to give a non legal translation:

> "A person can deduct from his taxable income expenses, including capital investment, that have been invested in scientific research in agriculture, industry, energy or transportation, provided the project has been approved by the appropriate authority appointed by the Minister for that purpose, and provided one of the following conditions is met:
>
> 1. The investment is by the company owner in one of these fields, in order to promote the business of his company.
> 2. The investment is that of a person performing the research work without owning the company, or by any other person who participates in the financing of the project and will receive rights reasonably proportionate to his investment in the project.
>
> In all cases there must be some govenment participation in the funding of the project."

The innovation in this regulation was, that until that time, only a company could deduct R&D expenses from its taxable income, and now this deduction is open to other tax payers:

1. A company owner can deduct expenses for R&D work carried out in his own company, or subcontracted to an Institute or University, provided the object of the project is to promote the business of his company, and provided the project has been approved by the appropriate authority.

2. A private person who carries out a research project, hoping to sell its results, provided there is government participation in the funding.

3. Any person, self employed or salaried, has the right to invest in an R&D project, without being part of the project, except as an investor who hopes to profit from his share in the results.

The main thrust of this Law was in the industrial R&D field, and the appropriate authority for approving the project is the Chief Scientist. It was stipulated that the private investors must have a reasonable share in the project, in order to put this deduction on a business basis, and distinguish it from charity and donations. The government participation in funding is intended to keep production in Israel, and to make sure the project is a viable one that merits some government financial support.

There are several additional technical regulations concerning this law that may be worth mentioning: The deduction is for actual payments and expenses, and not for obligations; only 35% of a person's taxable income can be deducted for this purpose; and of course, no project that already receives direct financial support from the government (50%) can qualify, because in that case the government may find itself financing 110% of the project.

The procedure for approving a project as a tax shelter is very similar to the one in regular R&D projects. The same application form is used, and the applier states in an accompanying letter that the project is for tax shelter purposes, and gives some details concerning the nature of the investors, and the funding agreement. The project is evaluated according to the same criteria described in chapter 3, but since the direct government financial support is small (5-10%), we are more liberal with the economic and marketing aspects, and will allow more long-range projects. Indeed this tax shelter has become a boon for University industrial R&D; Many people use it to donate money to the university, and possibly make a long-range investment at the same time.

Finally the project is brought before the Research Committee described in chapter 3, where it is also treated more lightly than the usual projects. However, the budget is treated with great respect, because this is really the name of the game. If the project is approved, the Chief Scientist issues an appropriate document (that includes the budget), which is recognized by the income tax people.

FOREIGN VENTURE CAPITAL.

During the past few years, foreign investors started discovering the Israeli innovative industry as a possible profitable investment. This type of investment is particularly attractive to American investors, who beside the expected royalties, may use this program under certain conditions as a tax shelter under U.S. tax laws. The government of Israel encourages this type of activity, and grants very convenient loans which can be used to finance a considerable share of the R&D project. Usually, a number of investors jointly participate in the financing of such a venture as a limited partnership, but this program is open to individual investors as well as companies. A considerable number of Israeli companies carry out R&D projects under this program.

The participating entities under the limited partnership arrangement are the following:

1. The American Limited Partnership. This is a group of private American investors, usually in the top income tax bracket. Its obligations are limited to the sum they have agreed to invest in the project.

2. The American General Partner. This is a company or a person who is active in raising the money and putting together a Limited Partnership. His responsibilities in the partnership are unlimited, and he is liable for the partnership's obligations. Throughout the project he must make sure that all the accounts are conducted according to U.S. auditing laws, and that all the documents are properly submitted to U.S. tax authorities. He must ascertain that royalties (if any) are properly received and divided between the members of the limited partnership.

3. The Israeli developing company. This is an Israeli industrial company that carries out the R&D project, and after its successful completion, manufactures and markets the product. This is also the entity that initiates and writes the R&D proposal, negotiates with the government for financial support, and negotiates with the General Partner.

4. The Israeli project partnership. This partnership is jointly owned by the American Limited Partnership and the Israeli developing company.

5. The Office of the Chief Scientist represents the Israeli government in this program. It evaluates the R&D proposal, and decides wether or not to approve it. It also monitors the execution of the project.

A project funded under this program is financed in the following manner:

10% will be invested by the Israeli developing company from its own resources, in parallel with the foreign investors.

36% will be invested by the limited partnership as income from its partners, from their own resources.

54% will be invested by the limited partnership as income from its partners, the source of this investment being a government loan. In practice the loan will be transferred directly to the developing company.

The conditions of the loan are the following:

1. The loan and its repayment are in U.S. dollars.

2. The principal will be repaid after 12 years .(Each project-year will have a respective repayment year).

3. The loan carries a 5% per annum interest. The first payment is after 4 years.

4. The loan is granted through a bank, and it carries additional bank requirements and conditions.

5. If the project proves successful and produces sales, the OCS will receive its usual royalties (3% of sales) described in chapter 3.

6. The royalties paid to the investors have to be approved as reasonable by the Chief Scientist.

7. The loan will be based on the approved R&D budget, and will not include expenses involved in raising the capital.

The government will sign an agreement with the legal entity that will own the know-how developed in the project. It can be one of the following:

1. The agreement may be signed with the Israeli Project Partnership which is jointly owned by the limited partnership and the Israeli company.

2. The agreement may be signed with the foreign partnership or investor, in which case they will establish an Israeli subsidiary.

In either case the Israeli company will have exclusive rights to apply the know-how in Israel.

There are many documents involved in setting up a Limited Partnership. I will mention the most important ones:

1. Project agreement. This is an agreement between the Israeli developing company and the OCS. It describes the R&D program, the budget, and the rights of the two parties.

2. Project partnership agreement. This agreement is signed between the Israeli company and the American General Partner. It describes the relations between the two parties, and their mutual financial obligations. It is reasonable for the investors to demand royalties from expected sales.

3. Loan agreement. It is signed between an Israeli bank representing the government and the limited partnership. It outlines the loan conditions.

The procedure for application under this program is somewhat similar to regular R&D projects. The proposer uses the regular application forms, and in an accompanying letter it states that the project is to be considered under the Limited Partnership program. He must also supply the following documents:

1. The expected cash flow in U.S. dollars year by year, until the completion of the project.

2. Full details concerning the identity of all the entities involved in setting up the Limited Partnership.

3. The principles of the agreement between the Israeli developing company and the General Partner, with special emphasis on the role of the developing company in production and marketing, as well as the royalties expected to be paid to investors.

4. The financial resources the developing company will use to cover its share (10%) in the project.

The project is evaluated regarding its techno-economic feasibility and brought before the Research Committee, according to the procedure described in chapter 3. The Research Committee debates the merits of the proposal, and if a favorable decision is reached, it approves the project "in principle". This means that the Chief Scientist may issue a letter of intent (in English), saying that our Office has approved in principle the project, including the budget. This letter is very useful to the General Partner in establishing the Limited Partnership, and raising the money.

Before the final agreements are signed by the Office of the Chief Scientist, several additional requirements have to be met:

1. When a new General Partner is involved, he must submit suitable bank recommendations, as well as testimony that he has no criminal record, and has experience in raising investment capital.

2. All agreements between the General Partner and the Limited Partners and those between the Limited Partnership and the developing Israeli company, must be submitted to the OCS.

3. A legal brief from a respectable American legal firm specializing in corporate and tax laws must be submitted. It should state that:

a) The project agreement, the loan agreement as well as all other agreements conform with the U.S. tax and corporate laws.
b) The organization of the investors' group, its relationship with the developing company and the financial support conform to the same laws.
c) Arrangements have been made that the Prospect should be approved by the S.E.C. according to its laws, or a legal opinion stating that the Prospect requires no such approval.

4. The first page of the Prospect should include the following paragraph:

> The Government of the State of Israel has not approved or disapproved these securities, nor has the Government of Israel passed upon (1) the accuracy or adequacy of any representations contained herein, including but not limited to, representations pertaining to tax consequences or (2) compliance of this offering with any applicable federal or state securities laws.

Any representation to the contrary is inaccurate and contrary to the contractual undertakings of the offerors.

5. The Prospectus must also be submitted. If a draft had been submitted, the original must be submitted as soon as available.

6. A legal brief from an Israeli legal firm must be submitted stating:

a) The Prospectus, as well as the various submitted agreements are the only existing agreements between the various parties.
b) Will elaborate the paragraphs in the agreement relating to the question wether the Israeli developing company has exclusive production rights in Israel. If the answer to that question is negative, what other arrangements have been made (beside the contractual obligation with the OCS), in order to ensure production in Israel.

7. The agreement will be signed only after the investors have deposited in a special bank account a sum of money deemed reasonable by the Office of the Chief Scientist.

The procedure as well as the documentation of this program is very complex indeed, the intention being to give maximum protection to the investors as well as to the government of Israel, without infringement of U.S. tax laws. Nevertheless it has proved a very effective and mutually beneficial instrument for raising venture capital for industrial R&D.

ISSUES ON THE STOCK MARKET.

In order to encourage the general public to invest money in stock issues related to industrial R&D, the government issued a special law making such investment tax deductible. In order to protect itself from tax fraud, and to protect the public, the government imposed some severe restrictions.

Only a company with an excellent track record in industrial R&D, as well as in the manufacture and marketing of innovative products, can be a candidate for such an issue. It must submit a comprehensive R&D program to the OCS, which is not easy: This is a program involving tens of millions of dollars, as opposed to the usual R&D projects with a budget of several hundred thousand dollars. The OCS evaluates the R&D program according to its own criteria, and the Israeli S.E.C. will not consider any application without this evaluation.

At present, only 2-3 companies have qualified, and only one of them came up with an issue of bonds, linked to the U.S. dollar, which can be converted to stock options after a number of years. Despite the fact that the law has been deliberated for years by the Knesset committee, and it is technically very complex, it was soon attacked by the press, and shrewd investors found they can make money due to very complex tax machinations which cost the government millions of dollars in unpaid taxes. At present

the law is under revision, so I do not think that it will serve any purpose to go too much into detail concerning its various technicalities.

And finally, a word of caution: This chapter (like most other chapters), tries to describe government policies, their implementation, and the principles of operation of the various programs. It is not an official document of the State of Israel, and should not be regarded as such by serious potential investors, for several reasons:

1. Many regulations have been translated from Hebrew by a non expert in legal matters (myself), and serious inaccuracies may have occurred.

2. I have omitted many points that have seemed to me too technical and unimportant. Some may prove to be very important to an investor.

3. I have described the legal situation that existed in the summer of 1985. The regulations keep changing all the time.

A serious investor interested in this type of program will do well to consult with an official economic representative of the State of Israel concerning the latest regulations, as well as with American lawyers and auditors concerning the possibility of the tax shelter involved.

BIRD F - PRINCIPLES OF OPERATION.

In a previous chapter I discussed at some legth the problems that a moderate size company, thousands of miles away from world markets, faces when it tries to penetrate a market already dominated by huge companies. I also pointed out some possible solutions to those problems, including international cooperation, which is actively encouraged by the Israeli government.

The traditional forms of international cooperation were: Establishment of subsidiaries to develop and produce new products based on Israeli technology (it should be noted that such subsidiaries are treated as regular Israeli companies in respect to R&D financial support); Joint projects with existing Israeli firms for mutual benefit; Marketing agreements in return for investments in R&D projects; Limited partnerships in innovative projects and companies, which have been described in some detail in a previous chapter.

It was felt however that a more institutionalized effort was needed in order to attract American companies to become true partners in Israeli innovative projects, and contribute some of their expertise and know-how in the R&D stage as well as in product definition and marketing. Thus, after long deliberations and negotiations, BIRD F was finally established (in May 1977) " to promote and support joint, nondefense, industrial research and development activities of mutual benefit to Israel and the United States."

Although several other binational programs of cooperation are in operation, and several other BIRDs are in the process of being hatched, BIRD is probably unique in providing a mechanism whereby funds originating from government sources are channeled directly into companies within the industrial sectors of the two countries to stimulate the joint creation and commercializtion of innovative technical (nondefense) products and processes from which both countries can derive pragmatic economic benefit. As such, and since BIRD F is usually considered a roaring success, well worth emulating, I propose to devote to it two chapters: the present one will describe the organizational structure, procedures, principles of operation, agreements involved, etc.; the following chapter will include a history of the Foundation, a description of its achievements, the problems it faced and their solution, and a general evaluation of the whole program.

THE AGREEMENT BETWEEN THE TWO GOVERNMENTS.

BIRD F (it stands for Binational Industrial Research and Development Foundation) was formally established in May 1977 through an exchange of letters between the two governments. Since this agreement gives a good description of the scope and structure of the organization, I intend to bring here the more relevant paragraphs. The numbers below refer to the number of the respective paragraph, and when I introduce my own remarks, I use quotation marks in order to distinguish from the original.

1. "...The principal office of the Foundation shall be located in Israel." Later it became apparent that the Foundation needed U.S. representation, so the representatives of the Israel Investment Authority, which are attached to several Israeli consulates, were charged with handling the U.S. business of the Foundation.

3. "The scope of industrial research and development activities which the Foundation may promote and support shall include all applied science activities in the process through which an innovation becomes a commercial product, including, but not limited to, product engineering and manufacturing start up".

5. "A Board of Governors... shall be the gpverning body of the Foundation... The Board shall consist of six members, three representatives of Israel and three representatives of the United States. ... The three representatives of Israel shall be the Director General of the Minister of Finance, the Director General of the Ministry of Commerce and Industry, and the Chief Scientist of the Ministry of Commerce and Industry or their designees; and the three representatives of the United States shall be the Assistant Secretary of Science and Technology, Department of Commerce, the Assistant Secretary for Oceans and International and environmental and Scientific Affairs, Department of State, and the Assistant Secretary for International Affairs, Department of Treasury, or their designees." In practice, the Department of Commerce appointed the Director of the National Bureau of Standards as its representative. The Board usually meets twice a year, in Jerusalem and in Washington alternatively.

6. "The executive Director shall be the chief executive officer of the Foundation. He shall be responsible for the operations and staff of the Foundation, and act in accordance with the policies, directives and delegations of the Board..."

7. Financial aspects. The original endowment of the Foundation was $60,000,000, provided equally by the Government of the United States and Israel. The money was deposited in the Bank of Israel, and the interest (after deductions for administrative expenses) was used to support joint projects in industrial R&D according to the decisions of the Board of Governors. In November 1984, reflecting the success of the Foundation in carrying out its objectives, the two governments decided to increase their respective shares, and the endowment is today $110,000,000, provided equally by the two governments.

8. "A. The Foundation's operations shall consist mainly of the selection, approval and monitoring of projects funded in whole or in part by the Foundation. All proposals for such projects shall be submitted through the Executive Director to the Board for approval.

B. Each proposal considered by the board shall:
(1) be submitted by Israeli or United States entities.
(2) show a mutually beneficial relationship between Israeli and United States entities.
(3) demonstrate the technical and economic feasibility of the

project.

(4) contain evidence that the applicant(s) is capable of carrying out the project, either alone or through partial subcontracting to universities, industrial research institutes or other qualified entities, and

(5) indicate that the applicant(s) will contribute from its own resources, or resources available to it, a significant portion of the financial resources required to carry out the project.

C. Each proposed project considered by the Board shall:

(1) promise a tangible, direct benefit to the national economies of Israel and the United States, such as significantly increased exports, maximized values, added or new markets;

(2) be of interest to both Israeli and United States industry, because, for example, it would result in a new need in the world market being met or the exchange of materials between Israeli and United States industry being increased..."

I feel that the excerpts from the agreement, including my remarks, give a pretty good idea of the organization of BIRD F and its objectives. The fact is that the Governors in their wisdom saw fit to add many additional rules, regulations anf resolutions, but I shall refer to them only as needed. I have also omitted many paragraphs from the agreement that seem technical in nature, and I hasten to proceed to the principles of operations, and the procedure involved in applying for a BIRD F grant, the evaluation of projects, the agreements involved, etc. which have evolved through the years.

QUALIFYING APPLICANTS.

Any pair of operating companies, one each from Israel and the U.S., may submit a proposal/business plan for joint development and commercialization of any nondefense, innovative, technology-based product or process that has the potential of yielding rewards commensurate with the investments and risks.

The clearest case of a qualified applicant is a company with R&D and manufacturing facilities, and a demonstrated capability in selling its products, typically developed in response to specifically identified market needs or opportunities. Since BIRD's headquarters are in Israel, the most usual first approach is by an Israeli company with a plan, or at least a concept, for a project. In some cases the company has lined up a potential U.S. company, and sometimes the representatives of the two companies approach BIRD together. In many cases, the Israeli company requests BIRD's help in matchmaking. And indeed one of its most important functions is this matchmaking operation: The executive director or one of his assistants make frequent trips to the U.S. carrying a briefcase full with potential profects proposed by Israeli companies. They try to arouse the interest of potential U.S. companies with complementary skills, and are often successful in forging such a partnership.

The two partners apply as a team on the basis of at least a preliminary understanding between them. The understanding may be conditional on the receipt by the partnership of a BIRD F award but, prior to the actual award, the partners will need to formalize an agreement that permits them to obligate themselves singly and jointly in a contract with the Foundation for that project. The agreement also spells the rights of each company, and it is closely scrutinized by the OCS in order to make sure that the project is indeed beneficial to the economy of both countries, as spelled out in the agreement between the two governments. This evaluation will be elaborated on in the next chapter.

Because of the wide range of projects and partnerships that may qualify for BIRD F support, there are no hard and fast rules for the detailed nature of the cooperation between the partners. They must make their own best judgement as to the most cost-effective division of activities to accomplish the technical and commercial goals of the project. For example, if the bulk of the R&D is to be performed by one partner (typically in Israel), the contribution of the other partner may emphasize marketing, and hence detailed product specification, sales and service. Institutions or nonmanufacturing companies may act as subcontractors in the R&D or testing phases of the project.

For many Israeli companies , the need for a qualified U.S. corporate participant to assist in specific product definition, in gathering marketing intelligence, and in sales and service, is vital in maximizing the potential benefits from ideas produced here. For many U.S. comanies, this is an opportunity to add to product lines by gaining access to Israeli-generated concepts and products, without the need for hiring new specialists. An additional incentive is that products manufactured largely in Israel qualify for duty-free entry into E.E.C. countries.

Since BIRD F is both by name and nature, an entity whose raison d'etre is mutual benefit through cooperation, proposals must be explicit in defining the activities in which each partner will engage, and the rationale for the proposed division of tasks.

QUALIFYING PROJECTS.

When the two potential partners have been located, and have agreed in principle to cooperate, the following step is to translate the concept into a cocrete project. Since the preparation of a complete joint proposal involves a considerable amount of work by the parties, there is an interim step when the project is discussed in great detail with the BIRD F staff, in order to find out if the project answers certain criteria. Accordingly, the discussion includes a preliminary evaluation of the capabilities of the companies, and of the nature and scope of the proposed project, the innovation involved and its techno-economical feasibility, including the history of funding from outside sources. The proposed budget is also discussed in detail, and this almost always results in a reduction, sometimes quite large, in the actual budget which will be submitted formally. Only if the BIRD F staff feels that there is a reasonable probability that the Board of Governors may approve the proposed project for funding, do they encourage the two companies to prepare the detailed proposal.

By and large the criteria used for project evaluation are similar to those of the OCS, as far as innovation and techno-economical feasibility is involved. Nevertheless, there are a number of additional considerations which stem from the nature of the project as a binational venture. There is also a current limitation in project size, that the total cost of the project should not exceed $800,000 a year for a maximum of three years. It should be noted that the average total cost of the typical project has been about $1,200,000 over a 2.5 year period, with BIRD F contributing about $600,000.

A proposal is therefore considered valid if:

1. It is submitted jointly by a pair of operating companies, one from each country.

2. Each company has a necessary and well-defined role in the development and commercialization of the innovation.

3. The proposed development appears technically and economically feasible, worthwhile in its risk/reward ratio, and achievable by the proposed partnership.

4. The proposed development can be accomplished within three years, at a total project cost of no more than $2,400,000 (of which BIRD F may contribute 50%).

5. Each company, and hence each country, will benefit tangibly from the success of the project, whatever the perceived optimum manufacturing agreements.

6. The project is clearly identifiable in the context of other projects of the companies, and is not co-supported by any government agency.

7. The resources of the companies, or of either one if a "joint venture" is proposed, are adequate to permit them to benefit commercially from the successful technical realization of the innovation.

BIRD F AWARDS

1. Preliminary awards. When two potential partners are confronted with considerable expense in preparing a proposal because of the need to visit each other specifically in that context, or because a preliminary market study is necessary, BIRD F can provide some financial assistance. In very special cases the amount may be as much as $10,000, as long as this promotes the preparation and submission of a proposal for a full-scale project of a quality likely to be approved by the Board of Governors. Such awards, however, are made sparingly; they are intended specifically to assist small companies for whom proposal preperation costs are burdensome.

Awards applications will be considered only if both potential partners to a project are identified, and furnish evidence of their interest in

cooperating under BIRD F sponsorship. The application should be in the form of a letter proposal which describes the general nature of the proposed project and the intended role of the partners, and includes the estimates of the cost and duration of the full-scale project. An itemized budget for the proposal preparation activities must also be included.

In cases where preliminary experimentation is required to determine the technical feasibility or market acceptability of a new product or process concept, the Foundation may grant up to $25,000 as its 50% share of carrying out the feasibility test. Such preliminary awards are made on the understanding that a formal proposal for a full-scale project will be submitted by the recipients for consideration by the Board, if the feasibility results are positive.

Applications for test of feasibility awards, which must be submitted jointly by the project partners, should include brief but clear description of the following:

- the companies;
- the innovation and its commercial prospects;
- the details and duration of the proposed experimental program, including itemized budget;
- an estimate of the cost and duration of a full-scale project to develop the innovation to the point of commercial readiness.

In the event that a preliminary award for a test of feasibility leads to a BIRD F-supported full-scale project, the amount of that award will be added to the Conditional Grant for purposes of payment to the Foundation.

2. Mini-projects. Projects whose total cost to the two proposing companies is $150,000 or less, and whose duration is one year or less, do not require Board of Governors approval. Each year the Executive Director may make a limited number of awards of up to $75,000 per mini-project as a 50% cost-share contribution. Proposals for such mini-projects should be prepared with the guidelines to the full proposal in mind (which will be shortly described in great detail), but need only be as extensive as is consistent with clarity. Every such project approved by the Executive Director will be subject to the execution of a Cooperation and Funding Agreement to be described later in this chapter.

The mini-projects prove a useful tool for the quick approval of small projects. They do not require the elaborate evaluation process by outside experts, nor do they have to wait for the Board of Governors. The Executive Director must report to the Board on the mini-projects he saw fit to approve.

3. Full-Scale Projects. Projects whose total cost exceeds $100,000, require approval by the Board of Governors. On approval, a one year Cooperation and Project Funding Agreement is entered into by the proposing partners and the Foundation. The Agreement describes the manner and amount of payments due the Foundation from sales or patents, and specifies the (modest) rights of the Governments and the Foundation with respect to patents and technology developed during the project.

When the project, as originally proposed, requires more than one year for completion, , BIRD F will view favorably a request for a second (and, where applicable, a third) year Agreement, subject to a healthy progress and to a continuing good market prognosis for the product (or process). A third year Agreement requires an announcement to the Board, usually followed by a brief discussion.

To ensure that any project that is to be continued from one year to another does so without interruption, the following steps are necessary: a) during the tenth or eleventh month of the year in question, a project review meeting be held with Foundation staff; b) the companies submit a budget and a work plan for the following year, which submittals will become part of the Cooperation and Project Funding Agreement for that year.

The BIRD F cost-share, typically 50% of the total project cost, is made in the form of a so-called Conditional Grant (in U.S. dollars), connoting that the recipients agree to make payments to the Foundation as a negotiated percentage of revenues eventuating from the project. Usually the Foundation requires to be paid 150% of the Grant, 100% within 4-6 years, and the balance, at a diminished percentage, over another few years (provided the product is still selling). If the project proves to be a technical or marketing failure, the Conditional Grant becomes a real grant, with almost no questions asked.

The BIRD F grant is made in three installment as follows: On execution of the Cooperation and Project Funding Agreement - an initial payment of up to 40% of the Conditional Grant; on receipt and approval of the semi-annual technical and fiscal reports - a second payment of up to 40%; on receipt and approval of annual (final) technical and fiscal reports - the balance due.

THE PROPOSAL.

Before a formal proposal is submitted, there will typically have been a number of discussions with BIRD F staff and visits by the latter to either or both of the proposing companies. However, while impressions gained from these contacts are important, in the last analysis, the formal evaluations and the Board's decisions must be based solely on the proposal as submitted.

The proposal contains the usual data, and I am not going to touch upon such obvious requirements as cover page, abstract, etc. I would like to dwell however on some of the major questions one has to relate to within the proposal:

1. The innovation. This section should include the following:

a) A description of the product or process concept, with emphasis on the degree to which initial feasibility has been proven.
b) the context of the innovation both in its relationship to other products and processes that have been developed by the

companies, and in terms of competitive approaches with which it is confronted.

c) A discussion of the patent situation, including background patents and the potential for new patents. Any obligations of the proposer to other agencies who have supported any part of the innovation development should be clearly described.

2. Proposed R&D Program. This section must describe the specific work that is proposed to achieve the objectives of the program. It should contain two subsections:

a) Analysis of the problem. The purpose here is to establish a credible basis for the proposed program. Its objectives should be analyzed in the context of the state of the art, with the intent of defining specific problem areas. Considerations include:

(1) Definition of the required properties and functions of the end item for use in the service environment.
(2) The achievements necessary to accomplish the objectives.
(3) Availability of suitable techniques or requirements for new developments.
(4) Technical and economical constraints.

b) Proposed approach. This section should be sufficiently detailed that one skilled in the art can evaluate it. It should include:

(1) A general plan of the proposed effort.
(2) For each task, the objective and the specific approach proposed, based on supporting data. Since the final objective is a product or process, tasks addressed should include prototyping, pilot production techniques or equipment, testing and evaluation, etc.

3. Program Plan. A chronological schedule of program activities should be presented in graphical form, with the estimated time required for the completion of each task, and with the milestones clearly indicated.

Specific task assignments of each of the two companies and of any R&D subcontractors or consultants should be delineated, together with a management plan for coordinating these activities. The plan should encompass the entire period of a multiyear plan.

The program plan will be incorporated into the Cooperation and Project Funding Agreement and used by the Foundation in monitoring project progress.

4. The market. The companies must include in their proposal a thorough analysis of the market prognosis. Such an analysis will typically include the following considerations, which should be addressed in this section of the proposal:

- what market need is served?
- what performance features and selling price, and hence manufacturing cost must be attained to penetrate that market?

- what is a reasonable projection of the rate of growth of sales of the product or process? what is the basis for this projection?
- what barriers, e.g. regulatory, might be encountered?
- who are the potential competitors? what are their weaknesses that can be exploited?
- what is the market strategy (e.g. occupying a certain niche)?

This does not purport to be a complete list. The basic message is that developing innovative concepts for commercial gain , is an intrinsically risky, uncertain, but occasionally highly rewarding undertaking, whose prospects of success can be immeasurably improved by acute, objective and early consideration of the market arena.

5. Commercialization. This section should analyze the financial exposure and potential return that the companies expect from the proposed project. What is the estimated investment cash flow and the projected earnings cash flow? Can the companies reasonably cope with the peak and aggregate investments that commercial success will entail? To what extent will partial achievement of sales goals be adequate to merit the initial investment? The BIRD Foundation recommends a cash flow analysis based on INNOVATION, by Milton D. Rosenau Jr. This procedure, or a similar approach should be used for this purpose.

Given an encouraging prognosis for the project, it remains to plan and implement the commercial program. Some of the questions to be discussed are as follows:

- will both companies engage in manufacture of the product or part of the product?
- who will sell to which market regions?
- do either or both companies currently have a suitable sales and service network, or does this have to be created ab initio?
- to what extent are the necessary resources for commercialization available within the companies?
- if additional resources will be required, how is it proposed to acquire them?

6. Cooperation and Benefits. The proposed division of tasks between the two companies presumably will have been discussed in earlier sections. This section will summarize the mode and extent of cooperative activity that is envisaged.

Key to BIRD F's participation in a program is the clear expectation of mutual benefits . An important factor in evaluating the proposal, therefore, will be the extent to which commercializtion of the innovation will aid both Israel and the U.S. in the form of new export markets, new employment opportunities, new capital formation, productivity improvements, etc. These issues should be fully discussed in the context of the agreement between the companies with respect to their agreed-upon roles in the commercialization process.

7. Organization and Management Plan. This section should contain a brief presentation of the proposed management procedures for the program, including the internal review procedures and overall management plan that will ensure, barring unforeseeable circumstances, implementation to design specification, on time and within budget.

An organization chart should be provided, which will indicate the relationship of this ad hoc organization to the formal hierarchies in the companies. Key project personnel, and their responsibilities in the program should be identified.

8. The Companies and the Project Personnel. In the last analysis, the determining factor in the successful commercialization of innovations is the people and the companies involved. The companies must provide full information about themselves and their personnel, including the following:

- record of performance in similar or related undertakings;
- degree to which the proposed project can be absorbed into the existing structure of the company;
- relationship of the proposed project to other company projects that receive support from outside agencies;
- financial information which demonstrates that the companies can not only contribute their share of the project cost, but have resources available for the commercialozation phase;
- resumes of key personnel;
- any additional information felt to be relevant, e.g. product brochures, expressions of interest by potential costumers in the products or processes to be developed, etc.

9. Project budget. Separate budgets must be presented for each of company's activities for each year of the project as proposed. The budgets for the first year should be as detailed as possible. Budgets presented for a second or third year should include a clear statement of what inflation factors, if any, have been included.

The budget should include the usual items: Labor costs (Gross annual salary including social benefits, % on project, cost to the project); equipment; expandable materials and supplies; travel (foreign and domestic); data processing costs; subcontracts; consultants; other expenses.

PROJECT APPROVAL AND FUNDING AGREEMENT.

The BIRD Foundation staff works in close collaboration with the proposing companies in order to prepare the proposal. They remark upon the various paragraphs, particularly on the budget, and often require additional data or a better presentation. What is most important, they give a frank estimate of the chances for approval, based on their experience with the evaluating and the decision making process. It must be stressed however, that if the proposers insist, the Foundation will submit almost any proposal for evaluation and decision, even if they consider the

chances for the approval of the project to be very small.

The full proposal is submitted in 5 copies: 2 copies are sent to the U.S. National Bureau of Standards (NBS), 2 copies are sent to the Office of the Chief Scientist (OCS), Israel Ministry of Industry and Commerce, and one copy remains at the Foundation.

Historically, NBS has evaluated proposals exclusively with respect to technical aspects: intrinsic scientific validity, quality of proposed technical approach, qualifications of identified staff, consistency of level and duration of effort with stated goals, etc. OCS typically has provided a more general evaluation, including the Israeli company's previous record of performance in related activities, the likelihood that product manufacture will be undertaken in Israel, the prospects for marketing and export from Israel. The Foundation makes its own evaluation, stressing the proposing team and the corollary benefits that might accrue from interaction between the parties.

After receiving reviews from NBS and OCS (a process that may take a couple of months), the Foundation prepares a brief synopsis of the project, including a specific recommendation for Board action, and distributes it to each Board member. If a Board meeting is in the offing, synopses are included in the material furnished to the Board for such a meeting. If no Board meeting is due within about 2 months of the completion of a synopsis, there is a procedure for approving a project via mail, telex or telephone, and indeed 2-3 projects are approved each year in this fashion.

At the Board meeting, there are usually a dozen or so projects up for consideration. After the Executive Director makes clear how much money is available for funding, each project is briefly described, the three evaluations are read and elaborated, and a brief discussion follows. After establishing priorities, a decision is quickly reached by the Board, almost always by consensus.

Once a decision has been reached, the Foundation swings into action again, and draws a Cooperation and Project Funding Agreement with the proposing companies. This is a very elaborate contract with six annexes - approved proposal budget, payment of conditional grant, linkage of conditional grant payments, program plan, royalty payments, license agreements. By and large the contract says that the Foundation agrees to pay the agreed amount, and the proposers agree to carry out the work according to the approved program plan, will make regular technical and financial reports, spend its funds according to the approved budget, and many other things that to the non legal mind seem to be self evident.

Probably the most important provision in this agreement. is the one made by the proposer to pay back to the Foundation a certain percentage of sales, in case the project becomes a technical as well as an economic success. This section of the agreement is very well written, and it protects the Foundation very nicely against attempts to avoid payments. I have mentioned before, that the OCS is less than successful in collecting its own debts in this respect, and may be part of the success of BIRD F in

collecting royalties can be attributed to the tight contract it has drawn. I therefore propose to quote the relevant section almost in full:

B.1. The Foundation hereby agrees to fund by Conditional Grant the implementation of the proposal in the maximum sum of $ or % of the actual expenditures on the project, as contemplated in the Approved Proposed Budget set forth in Annex A hereto, whichever is less, and at the times as may otherwise be set forth in Annex B hereto....

B.3. Proposer shall make payments to the Foundation based on Gross Annual Sales derived from the sales or other marketing, or commercial exploitation of the Innovation, including leasing, commencing with the first such commercial transaction. Such payment shall be made on the following basis: a) The Conditional Grant referred to in Sub.Sec. B.1 above shall be repaid in U.S. dollars at the rate of % of the first year's Gross Annual Sales, and, in succeeding years, at the rate of % of the Gross Annual Sales, such repayments to be in equivalent dollars valued at time of repayment. The rate of change of value shall be that designated in Annex C hereto. b) when repayment of conditional grant funds has been completed according to Sub.Sec.B.3.a)., the rate of further payments shall drop to one half of the last percentage referred to therein, such payments to continue until an amount equal to one half of conditional grant funds, in equivalent dollars valued at time of repayment (Annex C) shall have been paid to the Foundation.

B.3.1. The term "Gross Annual Sales" shall include all specific export incentives or bonuses paid the Proposer on account of sale of the Innovation for export, but shall not include sums paid for commissions, brokerage, value added or sales taxes on the sale of the finished product, or transportation and associated insurance costs, if same have been included in the gross sales price.

B.3.2. The Innovation shall be deemed to have been sold, marketed or otherwise commercially exploited if the Innovation, or any improvement, modification or extension of it is put to the benefit of a third party, whether directly or indirectly, and whether standing alone or incorporated into or cojoined with other hardware or processes, and for which benefit the said third party gives something of value. This provision shall not apply to transactions between the Participants and their subsidiaries. Should such subsidiary resell the Innovation separately identified or incorporated in a system, the sales price shall be the price to third parties from the subsidiary making the sale, such sale price being defined by the same criteria as sales are defined for purposes of "Gross Annual Sales" in Sub.Sec.B.3.1. above. If the Innovation is a part of a product sold, marketed or otherwise commercially exploited, the sales price of that product multiplied by a factor whose numerator is the manufacturing cost of the Innovation and whose denominator is the manufacturing cost of the product. If there shall have been established a market price for the Innovation, such price shall be the basis for payments according to Sub.Sec.B.3., notwithstanding the incorporation of the Innovation in another product.

Once the project has been approved and signed by all parties, BIRD F adopts a somewhat passive role. It monitors the project to some extent, mainly by examining the technical and financial reports. Sometimes it may act as a troubleshooter if the need arises: this may take the form of trying to settle small arguments between partners, or in some cases, of finding a new partner, if for one reason or another (e.g. reorganization, new ownership, bankruptcy, etc.), one of the companies is leaving the partnership. But by and large, the role of the Foundation is restricted to such mundane occupations as reading technical reports, auditing the books, and what is most important, trying, usually with success, to collect the due royalties in the case the project is a technical and marketing success.

The purpose of this chapter was to give a detailed description of the principles of operation of the BIRD Fondation, and of the steps involved in preparing a proposal, having it approved, etc. The next chapter will give a brief history of the program, discuss the criteria and factors considered in evaluating projects, and describe the problems encountered by the program, as well as its successes and and achievements.

BIRD F - PROBLEMS AND ACHIEVEMENTS.

BIRD F must be considered a success. It is so considered by the U.S. Department of Commerce, who has published a pamphlet citing BIRD F as a prime example of binational cooperation in industrial R&D, and is now hatching several BIRD like agreements with other countries. Israel was even faster, and during the past four years, it has signed agreements with four other countries for binational cooperation similar, but far from identical to BIRD. These agreements will be elaborated in subsequent chapters.

The total number of projects funded, or in process of funding (up to August 1985), since the first in mid 1979, stands at 100, involving expenditures or obligations of about $28 million to the 200 companies, 100 from each country. Since the BIRD commitments constitute only about 50% of total project cost, the total R&D level represenred by these figures amounts to about $56 million. 30 projects have begun to generate sales, and the exports from Israel of BIRD developed products, stand at $150 million, with an additional $85 million predicted for 1986.

Despite its present success, BIRD F took a while before it started operating at full steam. It had its share of childhood problems, and its budgeting posed some special difficulties, especially as BIRD F was treading through virgin land. I believe therefore, that it would instructive to start with a brief history of the BIRD Foundation.

HISTORICAL BACKGROUND.

The background of the Foundation dates back to July 1974, when the governments of the United States and Israel established a Joint Committee for Investment and Trade. This Committee was staffed by representatives of the two governments, and its task was to find the means to promote closer economic ties between the two nations.

In May 1975 the Joint Committee met and explored the question of industrial research and development cooperation between the two countries. The Joint Committee agreed at that time upon the desirability of developing a program to support mutually beneficial industrial research and development activities. A series of discussions was held through 1975 and early 1976 between representatives of the two governments concerning the establishment of a jointly funded foundation to promote industrial research and development activities of mutual benefit and interest to both countries.

Even before the Joint Committee began discussing the question of cooperaton in industrial research research and development between the two countries, a private sector group was formed whose goal was to promote closer links between U.S. and Israeli scientific and technological enterprises. This group, the Binational Industrial Research and Development Council, was established in February 1975. Its membership is composed of leading research and development executives from both U.S. and Israeli industry. The Council was instrumental in providing advice and support during negotiations for the establishment of the Foundation.

Council members were able to evaluate the potential for mutually advantageous cooperation in industrial research and development, making their views particularly valuable.

As discussions continued between the two governments, another significant private sector activity was taking place. The Committee for the Economic Growth of Israel (CEG-I) was formed during March 1976. CEG-I is an autonomous, voluntary organization of American and Israeli business people who joined forces to promote exports and investments in Israel. Working through a network of local task forces of business people in various United States communities, CEG-I began to seek out American firms who were willing to cooperate with Israeli companies to achieve mutual benefits.

The Agreement establishing the Binational Industrial Research and Development Foundation was signed by the U.S. Secretary of the Treasury William Simon, on behalf of the United States, and by Israeli Finance Minister Yehoshua Rabinowitz, on behalf of Israel, on March 3, 1976.

Shortly thereafter, the private sector again showed its support for cooperation between U.S. and Israeli firms. The Israel-U.S. Business Council, composed of top executives of Israeli and U.S. industrial corporations held its inaugural meeting in June 1976. The U.S. section was headed by George W. Romney, and the Israeli section by Mark Mosevics. The Council visited Israel, and returned with a series of proposals and suggestions for joint cooperation between U.S. and Israeli firms.

In late April 1977, the U.S. Congress passed the legislation providing for the funding of the Israel-U.S. Binational Industrial Research and Development Foundation. This was signed into law by President Carter on May 4, 1977. At the same time the Knesset, Israel's parliament, authorized the funding of the Israeli portion of the Foundation's endowment.

The Foundation was formally established in a ceremony in Washington D.C. on May 18, 1977, with the exchange of letters between Assistant Secretary of the Treasury Bergsten and Ambassador Dinitz.

The inaugural meeting of the BIRD F was held in July 1977, attended by the Board of Governors of the Foundation and their advisors. The Board of Governors consisted on the U.S. side of Dr. Jordan J. Baruch, Assistant Secretary of Commerce for Science and Technology; Dr. C. Fred Bergsten, Assistant Secretary of the Treasury for International Affairs; and Patsy T. Mink, Assistant Secretary of State for Oceans and International Environmental and Scientific Affairs; and on the Israeli side of Dr. Moshe Mandelbaum, Director General of the Ministry of Industry, Trade and Tourism; Amiram Sivan, Director General of the Ministry of Finance; and Professor Yitzhak Yaakov, Chief Scientist of the Mninstry of Industry, Trade and Tourism. At that meeting, the Board of Governors elected Professor Yitzhak Yaakov as Chairman of the Board. A. Wade Blackman, Jr. was selected as the first Executive Director of BIRD F.

Here activities ground to a halt to some extent, and the fact remains that for the first two years of its existence, BIRD F didn't award any

full-project grants, even though the money for such funding was available. One can discuss endlessly the reasons for the Foundation's failure to fulfill its most important function, but in my opinion, the main reason was the very complicated guidelines that were published in March 1978. Those guidelines made the preparation of a proposal extremely difficult, and its evaluation even more so; the guidelines were so difficult to understand (let alne comply with), that I know of a major U.S. corporation, who should be extremely experienced in preparing such proposals, and yet they had to hire a special consultant just to prepare that proposal. The Israeli companies had even a harder time, and even though BIRD F initiated an award of $10,000 for the purpose of proposal preparation, it did not help matters much.

Dr. Blackman resigned his position in early 1979, and the Board of Governors selected Dr. A. I. Mlavsky as his successor. Dr. Mlavsky greatly simplified the guidelines and the principles of operations of the Foundation, and the new ones are described in detail in the previous chapter. BIRD F was finally on its way: the Board approved 6 projects in 1979 ($1.3 million), 5 projects ($2.0 million) in 1980, 6 projects ($3.1 million) in 1981, and 9 projects ($3.1 million) in 1982.

BUDGETING PROBLEMS.

As the fame of BIRD F kept spreading, and companies found the proposals easier to prepare and decided upon, new applications kept coming in ever increasing numbers. The initial endowment of $60 million was generating a primary income of some $3 million, and the royalties from BIRD F projects was almost negligible (the first sale of BIRD F developed products was in 1981). The reason for the primary income (as interest from the endowment) was relatively low, was a very complicated formula whereby the original endowment was split into two accounts, one linked to the U.S. dollar, and the other one linked to the index of living.

Even the relatively low level of project approval was made possible by the fact that there were some unused funds left over from the first two years of almost no funding activity. There is also a marked difference between contractual commitments and actual cash disbursements (e.g. in 1979 the contractual commitment was $1.3 million, and the actual cash disbursement only $0.3 million), so the cash flow picture did not look too bad. On the other hand, most projects were multi-year projects, so even though the actual contractual commitment (always on a one year basis) was relatively small, one had always have to take into account a much larger implied commitment. This is the reason the Executive Director saw fit in early 1982 to draw the Governors' attention to the fact that BIRD F was facing a shortage of funds.

The first reaction of the Governors was to ask the Executive Director to prepare a more lucrative royalties scheme. At that time, companies had to repay (in case of economical success) the original conditional grant, indexed for the inflation of the U.S. dollar, but without interest. The Governors felt that the Foundation had to make some profit on the successful projects, in order to make up for the failures.

The Executive Director wrote an extensive document (in May 1982) in which he brought up the example of the former National Research and Development Corporation of the U.K. (NRDC), which imposed on its grantees a rather ingenious formula for repayments as follows: In exchange for NRDC's 50% contribution to the total cost of a development project, the grantee agrees to make payments at the rate of 4% (typically) of sales until the original NRDC investment is repaid, plus interest of 10% per annum (typically). Thereafter, the grantee continues to pay royalties at half the original rate (2% in this case) for a period of time equal to that which is required from the start to the finish of the 4% payments.

Clearly, if the grantee attains or exceeds his (usually optimistic) sales forecast, he pays off the NRDC investment (plus interest) rapidly, and hence is on the hook for additional royalties for a relatively brief time. If his performance is laggardly, he finds himself paying 2% of sales for a corresponding long time.

After some deliberations, the Board of Governors adopted a somewhat similar formula for repayment at their meeting in December 1982. The main difference is that instead of interest, the formula calls for constant dollars, i.e. the repayment is indexed to the dollar inflation. The repayment continues at a reduced rate, until 150% of the original grant is paid off. It would be interesting to note that this is a departure from the regular OCS grants, where the repayment continues only until 100% of the grant, indexed for inflation, has been paid off.

However, this change in regulations, could by no means solve the budgeting problems of the Foundation, certainly not on a short or medium range basis. At the time of this financial debate, BIRD F income from royalties was $24,484. Even the most optimistic forecasts did not expect significant income from royalties before 1986, and certainly no significant impact on the BIRD F budget for many years thereafter (the cumulative figure to mid 1985 turned out to be $1.5 million in royalties). It can be shown that even with the 150% repayment formula, you would need a rate of success of well over 60% of projects paying the full 150%, before you break even.

Indeed, the Executive Director presented (in 1982) a thorough financial analysis of BIRD F, and described in some detail 4 possible cases:

Case 1. Baseline. This describes the situation which will arise if no additional primary income is provided or planned. In this eventuality, the Foundation will be unable to initiate virtually any new full-scale projects during fiscal years 1985 and 1986. Thereafter a steady-state level of operation of 7-8 average-size new projects per year will be possible.

Cases 2-4 are based on receipt by the Foundation of an additional $4 million per year - 8% interest on $50 million provided in equal shares by the two governments.

Case 2. New income commences in October 1985. In this eventuality, new project starts possible in 1985 drop to a very few, rise to about 7-8 in 1986, and approach a steady-state level of 16-18 thereafter.

Case 3. New income commences in April 1985. In this eventuality, new project starts possible in 1985 drop to 5-7, and then rise towards a steady-state level of 16-18 thereafter.

Case 4. New income commences in October 1984. In this eventuality, steady growth of Foundation activities can continue with little or no interruption, to the steady-state level of 16-18 new project starts per year.

I am happy to report, that the Governors were impressed with that analysis, and with the BIRD F record to that date, and being senior officials of their respective governments, got to work to obtain additional funding. Within two years, that is by the end of 1984, the endowment was increased by $50 million ($25 million from each government), and the primary income increased from $3 million to $7 million per year. Anyone familiar with the difficulties of obtaining new appropriations from the government, will agree that this was a very happy ending to that financial crisis.

THE PARTNERS.

What attracts an American company to Israel? Israel has a disproportionately large reservoir of highly trained and motivated personnel, an energetically espoused national goal of the development of its intellectual resources for the expansion of its science-based industry complex, a strong financial incentives program and favorable relationships with many markets, including the right to export locally made products duty-free to EEC countries. It also has a proven capability to develop and manufacture sophisticated technical products that can compete in world markets.

To a great extent, Israel approximates a small scale model of the U.S. with respect to high technology industry. U.S. companies, much more so than their European counterparts, feel at home in Israel because of striking similarities in basic approaches to invention and its maturation into innovation. Another sign of that affinity is the growing list of Israeli companies traded on U.S. stock exchanges; generally, the companies and their stocks have performed well.

For the Israeli company, the advantages of such a partnership are even more obvious. Encouraged by the performance of established technical industries, (few, however more than a dozen years old), more and more new companies are being formed. A major problem confronting these new start-ups and other small companies, however, is that the local market for non defense technical products is too small to justify the cost of their development. And to develop a product for, say, the U.S. market requires detailed knowledge of the product specifications, as well as a well defined route to get the product to the customer and to provide him with the applications engineering and after-sales service that are the sine qua non for acceptability.

The Israeli company is faced with a classical "catch 22" situation: without a physical presence in a major market area , one cannot generate growth; but without growth, one cannot afford that presence. In cooperation with a U.S. partner however, the Israeli company can concentrate its efforts on innovation and new product development. Market research, product specification and its iterative refinement through interaction with potential end users, are contributed by the U.S. company.

A successful partnership may have other ramifications as well: For example, a U.S. company introduced to Israel, as it were, on the basis of the possibilities of a joint R&D project may find that his partner-elect is well qualified to handle distribution of that company's existing products, both in Israel and in Europe. Reciprocal agreements on existing products are becoming quite common, as are second R&D projects, following a successful first project with BIRD F.

When a small Israeli company - and most of them are small - finds an apparently suitable U.S. partner who has the skill and resources to provide what is needed to enable the development and commercialization of a new product concept, it may also have found a potential competitor.

At best, BIRD-type partnerships must be regrded as good only for certain phases of the smaller company's growth. Sooner or later - and not too much later - it must have its own presence in the geographic areas that bound the markets. The marriage of convenience is a marketing crutch, but must eventually be replaced by home grown legs.

Experience has shown that the probability of success of a U.S. company - Israeli company project, including the likelihood that it will even get started, is a strong function of the size of the former. Assuming the Israeli company to be of "average" size, meaning quite small by U.S. standards, the optimum range size for the U.S. company is $10-100 million a year of sales in a well-defined market area. Thus, if the U.S. company is very small, communications, empathy, ambition, etc. may all be good, but resources are lacking, singly and severally. If the U.S. company is very big, there are too many levels of decision-making, too much pronenness to corporate musical chairs, too little importance of the project in the overall scheme of things. When the actual partner is a largely autonomous division or subsidiary of a much larger corporation, the probability of success is enhanced.

If we look at the record of BIRD flops, including approved projects that never got off the ground, we find the two too-small company partnerships, and the very small-very large partnerships, which either did not actually materialize, or subsequently came unstuck.

PROJECT EVALUATION.

When the OCS professional reviewers evaluate BIRD projects, they use to a great extent the criteria applicable to regular OCS projects - innovation, techno-economical feasibility, company resources, etc. Yet there are several basic differences due to the nature of the projects as a binational cooperation effort, which I would like to elaborate:

1. The partners. One of the main objectives the Founding Fathers of BIRD had in mind, was to attract major and/or successful U.S. companies to cooperate with Israeli companies for their mutual benefit. Israeli companies have a well deserved reputation for their ability to translate innovative ideas into new products, Israel has a large pool of talented scientists and engineers, and BIRD would be an additional inducement for U.S. companies to invest in Israel. Successful partnerships that have started with a joint R&D effort, would generate additional agreements in joint production, marketing, etc.

Thus the first question we ask, is if the U.S. and Israeli partners are truly different companies. If the answer to that question is positive, and the U.S. partner is indeed a viable, competent enterprise, which has not previously benn thus involved, this factor weighs heavily in the project's favor, and we might go a little easy on, say, the innovation aspects.

Quite often, however, we get proposals from companies with partially or totally common ownerships. Thus we have had applications from Motorola in partnership with its very active Israeli subsidiary. Or the other way around, applications from Elscint (a major Israeli company specializing in medical imaging) in partnership with its U.S. subsidiary. Less obvious are the cases when there is partial ownership either way.

Obviously we don't need BIRD in order to introduce Motorola to its own subsidiary. On the other hand, if the project is a good one, why not? Our policy is therefore to give first priority to projects where new. competent U.S. companies cooperate with an Israeli company in a joint R&D project. When the two prospective partners are not complete strangers. we insist that we be thus informed, and assign second priority to those projects.

We do draw some lines: there have been cases where Israeli firms have established a U.S. subsidiary, the major purpose being to obtain a BIRD award. We have found sometimes that one of the potential "partners" was a sales office, and sometimes even less than that. We insist therefore that the two partners are viable companies, which can make at least a minor contribution to the joint R&D effort.

2. The partnership. The very name of BIRD F implies that each project should be a binational cooperative effort in industrial research and development. Ideally, two companies should have complimentary skills and know-how, and should engage in a project where by pooling their skills they obtain a cynergetic effect, where the whole is greater than the sum of its parts. Again ideally, the R&D effort should be equally divided, each company doing the work it knows best, with lots of coordination and communication as the work progresses.

Ideals are however seldom realized in life, or in BIRD F projects. Since the BIRD office is located in Israel, most projects are based on ideas and concepts originating with the Israeli company, and the bulk of the R&D work is accordingly carried out in Israel. Typically, the U.S. company concentrates on market surveys, product specification, adaptation of technology, etc.

This is all very well, since the tasks the U.S. company is performing are extremely important, and necessary for the success of the project. The only trouble is that those activities do not meet the OCS (or anybody else's) definition of what constitutes R&D. Here the BIRD Founding Fathers have come to our help, and article 3 in the Agreement between the two governments says: "...the Foundation may promote and support...all applied science activities in the process through which an innovation becomes a commercial product, including, but not limited to , product engineering and manufacturing start up."

Thus the door was open for partnerships between a company performing most of the R&D on one hand, and a company that essentially deals with marketing on the other hand, and many avtivities that do not meet the strict definition of research and development could be included in the budget. Nevertheless, even here one could not go to extremes: we could accept a partner that performs many technical and professional functions related to marketing, but not a simple sales outlet.

3. Production in Israel. This is probably one of our most sacred principles, since the basic objective of our whole program, is the development of a science-based industry in Israel, specializing in the export of innovative, technically sophisticated products. Indeed the most important paragraph in the contracts signed in the case of regular OCS projects, is the one insisting on production in Israel. We strenuously object to the sale of know-how, and will not finance a project in which an Israeli company is selling R&D services.

Israel would dearly love that each and every successful project sponsored by BIRD F would result in production in Israel. It is true that the agreement between the two governments says nothing about that. However, Article 7C does say " Each proposed project...shall promise a tangible, direct benefit for the national economies of Israel and the United States..." The attitutde of our government is that only production in Israel (and the resultant export from Israel), assures a direct, tangible benefit to our economy. By and large the American representatives on the Board of Governors have accepted this insistence, although in rare cases, they did point out that production in Israel is not mentioned in the original Agreement.

Here is the place to remark that "production in Israel" is not a black and white situation. In the case of machinery, chemicals, electronic equipment, etc. the term is very clear. In the case of software, the term "production in Israel" is much less clear, so we insist that the economy of Israel benefits handsomely in the form or royalties from sales. The design of microchips is even more ambiguous, since a good design center can become a large employer and a good exporter, even though it does not manufacture goods. In this case, we decide each project on its merits.

4. Innovation and budget. In the case of BIRD F projects, there are other factors beside innovation which are considered more important. Thus if the U.S. company is successful and competent, it weighs very heavily in the project's favor. As mentioned before, many activities which are not recognized as R&D under our narrow definition, are accepted in the case

of BIRD F projects. This includes not only activities related to marketing, but also a larger number of prototypes, pilot plant, field testing, etc. We are also more liberal with travel expenses: In regular OCS projects, we are very suspicious of travel abroad, and seldom, (and stingily), recognize such expenses; in the case of BIRD F projects we accept the fact that a binational project requires a great deal of travel in order to improve coordination and communications, and recognize such expenses as an integral part of the project.

THE PROJECTS.

In the six years between mid 1979 and mid 1985, the BIRD Foundation has approved 100 projects, involving expenditures or obligations of about $28 million to the 200 companies, 100 companies from each country. For about half of the U.S. companies, the BIRD project represented their first serious involvement with Israel. Since the BIRD commitments constitute only about 50% of total project cost, the total R&D activity level represented by these figures amounts to about $56 million.

Of the 100 projects, 64 were full-scale, 23 were mini projects, and the other 13 were tests of feasibility projects. The breakdown according to disciplines is as follows:

Electronic equipment and instrumentation	27%
Medical equipment and instrumentation	15%
Agrotechnology	15%
Machinery and equipment	15%
Software packages	19%
Miscellaneous	9%

It takes a while before an industrial R&D project begins to generate sales, so it is not surprising that the first sale of a BIRD F supported project occurred in 1981. By August 1985 30 projects have begun to generate commercial sales, and the total export from Israel of BIRD products totaled $147 million, with an additional $95 million predicted for 1986. BIRD has received cash repayments of over $1.5 million as royalties on sales.

It is very difficult to give a definite percentage of successful projects. At any particular moment, the jury is still out on a number of projects, and BIRD is too young to make possible a historic overview of its commercial successes and failures. Nevertheless a fair assessment would be:

Very good bets, some proven	28%
Promising possibilities	42%
Flops or likely flops	30%

Best estimate of overall success ratio: 50-60%.

A lumped measure of the success of the Foundation, is the total sales generated from BIRD products. While obviously a few winners compensate for a lot of losers, the above mentioned figures of exports from Israel, would

seem to signify that overall success has, indeed, been achieved. A much higher success rate will be undesirable, since this would imply an insufficient willingness to share in reasonable risks.

The flops include projects which have had, or will have, sales, but for which it is estimated that the sales will not justify the investment in R&D. Nonetheless, quite a few of the projects that are "flops" or on the negative side of "possibles", were important to the companies in furthering their growth and experience. The operation may have been a failure, but the patients may live healthy lives thereafter.

What are the characteristics of the losers? From the failures and probable failures, several almost obvious problems can be identified:

1. Inadequate marketing capability (often related to next factor)
2. Underfinanced companies (either or both partners)
3. Mismatched partners (size, capabilities, relative importance of the project to the partner)
4. "Companies" attached to educational or other non-profit institutions. (Israeli universities and government laboratories often have such "companies")
5. Capital equipment developments that are destined for use in basic industries.
6. Basic research, however cosmeticized to look applied.

And what are the characteristics of the winners? Key factors include professionalism from both partners, and resources adequate to the overall task of development and commercialization. Without good communications between the partners, other plusses will prove insufficient.

Among the winners and probable winners, there is a disproportionately large number of projects between partners where there is substantial or complete common ownership. Such partnerships will typically enjoy good communications and a clear common interest in success. This factor should be given some weight, but not overwhelmingly so, since the primary objective of BIRD F is to promote cooperation between totally independent companies.

AN ANALYSIS OF BIRD F .

How worthwhile an enterprise is BIRD: In concept? In practice? A qualitative answer to the first question, and even to the second one, is a resounding "very". A quantitative answer would be a lot more difficult, but an attempt to quantify some aspects of the BIRD F operations and results would be worthwhile.

1. Sales per dollar of R&D costs. An important figure of merit for any R&D project is the total dollars of sales produced per dollar of R&D expenditure. Attainment of a ratio of sales of R&D cost of no less than 6 to 1 would be described as a success.

Since BIRD F has such a short history, one can only project the range of values of this ratio which is likely to be attained. Based on the first

approximately $15 million of BIRD F investment, representing a total R&D cost of about $30 million (50% cost-sharing by BIRD F), it would seem that the sales to R&D cost ratio will be between 8 and 10 to 1.

While this number appears high compared with that commonly attained in well-managed R&D-based economies, it is characteristic of what has been achieved in Israel since its barely more than a decade entry into sophisticated industrial R&D.

That BIRD F can aspire to catalyze and co-sponsor R&D projects which average such high returns, it is submitted, to the intrinsic validity of the hypothesis that complementarily talented corporate partners - in this case, one each from Israel and the U.S. - can frequently develop and commercialiize innovative concepts more rapidly and effectively than could either of them alone.

2. Leverage. Industry based on R&D, while central to the U.S. economy for over a century, is about 15 years old in Israel, where new, small technical companies abound. The U.S. too, hardly lacks in vigorous new start-ups.

Funds for R&D, while critically important in the early stages of a new company's development, are not the only funds required. In fact, success in R&D leads directly tc the need for relatively massive investment to exploit the opportunities so created.

Based, perhaps on equal measure, on the rigorous evaluation of proposals submitted to BIRD F, on its record of performance, and on the fundamental soundness of the concept of projects jointly executed by the right partners, outside sources of venture capital are increasingly finding their way to BIRD F grantees. The investment by the two governments, more than returned to their treasuries through taxes paid by personnel and companies who manufacture products resulting from that investment, is thus further leveraged by the participation of capital from the private sector.

3. Indirect benefits. A major activity of BIRD F involves match-making between U.S. and Israeli companies who appear to have something to gain from joint enterprises, with or withou direct financial support from the Foundation. While it is difficult to quantify, the value of BIRD F in initiating such binational corporate relationships is becoming increasingly more evident. As it was already mentioned, many U.S. companies, whose first step in Israel was a joint R&D project, find other benificial forms of cooperation, such as production or marketing.

As an independent center for the promotion of joint U.S.-Israel technically-based industrial activity, BIRD cooperates with a wide range of public and private institutions and companies. To the extent that it helps increase exports from Israel and to stimulate the growth of Israeli science-based industry, always with concommitant direct U.S. benefit, it contributes to a decreasing dependence of Israel on outside economic support.

4. Direct return to the governments. A baseline quantification of the value of BIRD can be arrived at by comparing the money that is being spent by the governments with the direct return which they receive in the form of taxes.

According to various U.S. Bureau of Economic Analysis surveys and statistical tables, for each dollar of sales by a U.S. manufacturing firm, the total of direct and indirect taxes paid to the U.S. government is about $0.20. For want of similar information for Israeli manufacturing operations, let us assume that the figure is about the same as for the U.S., although the Israeli economy is more heavily taxed, and intuitively I would suspect the figure to be much higher.

If we take a figure of $60 million of export of BIRD F products from Israel in 1985 (the exact figure is not available at the time of writing, but this is a good, conservative estimate) that means that the governments have received an income of some $12 million. This greatly exceeds the $7 million that BIRD receives as a primary income from the endowment provided by the (lucky) governments.

This analysis is very conservative, and the direct returns to the governments should be much higher:

a) As BIRD F grows older, more and more projects generate sales. The forecast for 1986 is $85 million export from Israel of BIRD F products. The endowment and the primary income will probably remain stationary for the foreseeable future.

b) The figures quoted above represent most often transfer prices to U.S. companies for products manufactured and exported from Israel. The total sales to end-users include value added by U.S. companies in terms of incorporation of those products into systems, installation, and after sales service. Accordingly, the total sales ascribable to BIRD F products are considerably higher than those reported, or predicted for the future.

c) The figure of $0.20 is probably far too low for Israel.

Analysis of the BIRD program's success can be attributed to several factors (not necessarily in order of importance):

1.An extremely competent Executive Director.

2. A small capable management staff covering technical, financial and administrative areas.

3. No political interference.

4. A governing board for policy guidance.

5. Removal from concern of annual appropriation requirement.

6. A slow start initially, but then a momentum of its own.

7. High credibibity within the technical and entrepeneurial communities.

8. The existence of persons highly educated in technology in Israel.

9. The existence of a vigorous government program of support for industrial R&D in Israel.

10. Good (but not perfect) communications between Israel and the U.S.

11. A multiplier effect - once interactions are established, they proceed without interference from the BIRD office

12. Transition from partial funding to management review.

THE ISRAEL - SOUTH AFRICA PROGRAM.

The Israeli government was impressed and pleased with the success of BIRD F, and suggested to several other countries to enter into similar agreements. Within the last 5 years, four such agreements were indeed signed, similar but far from identical with BIRD. The South African program was the first one to get under way, and since it is a different model of binational cooperation in industrial research and development, I believe it would be instructive to describe it in some detail.

(Here is the place to remark that in South Africa, industrial research and development is organized far differently than in Israel. While in Israel much of the industrial R&D is carried out "in house", South Africa has a large Research Institute (CSIR), and most of the industrial R&D is carried out there. Much of the work at CSIR is not commissioned, so CSIR has established a subsidiary called SAIDCOR, whose main objective is the commercialization of various inventions developed at CSIR. Thus SAIDCOR found itself financing many projects, and after a while it started funding industrial R&D projects submitted by private companies, an operation somewhat similar to that of OCS. Several important differences exist: SAIDCOR is not an integral part of the government, and the scope of its operations is much smaller than that of OCS, and consequently it has a smaller impact on the national economy.)

Preliminary discussions on the establishment of a program of cooperation in industrial research and development took place during the meetings of the Israel - South Africa mixed economic commissions in 1980 and 1981. The mixed economic commission is a forum where senior economic representatives of the two governments meet in order to discuss economic problems of mutual interest. The two delegations agreed that such a program might be a good idea, and a South African delegation arrived in Israel in June 1982 to discuss ways and means of implementing such a program of cooperation in industrial R&D.

In preparation for that meeting, we prepared a proposal closely modeled after BIRD F, with two important differences:

1. Instead of depositing a large sum of money ($60 million, later increased to $110 million, in the case of BIRD F) in the bank, and funding the projects with the interest, we suggested each government allocate $1 million from its budget each year, increasing (or decreasing) the amount as the need arises.

2. The operating expenses of BIRD F are around $400 thousand a year (salaries, rent, logistics, etc.). In order to save most of that amount, we suggested that a government official (alternately from each country) would be appointed as Executive Director of the Foundation, and that his operations be carried out from his government office, thus saving most of the operating costs.

Otherwise we suggested the establishment of a very similar organization, complete with a Board of Governors with equal representation for the two countries, which will decide on policy matters, as well as approve

projects and allocate funds. We also described in general lines the type of projects we want in our program, as well as the criteria required for their approval.

The South African delegation studied our proposal, and did not like it too well. They said that their government is very allergic to new organizations, and they would be reluctant to establish another one. If two companies want to cooperate, let the Israeli company obtain its funding from OCS, and the South African company from SAIDCOR, each according to its rules and criteria.

We replied that this is not real cooperation, and that companies can apply to organizations in their respective countries without the benefit of an agreement between the two governments. What is even more important, our experience has shown that matchmaking and cooperation between two distant companies is a very complicated process. The BIRD F Executive Disector and his three able assistants, work very hard in order to obtain some results; no cooperation can be expected without some organization, as well as full-time employees.

After long and elaborate negotiations, a sort of compromise was reached, and a three page memorandum was duly signed by the respective Directors General of the two Ministries of Industry. No new organization or Foundation was established, but a more comprehensive program of cooperation was envisaged. Accordingly, the memorandum included several important provisions

1. "Each country will assign an appropriate organization and a program manager to implement the functions of the program."

2. "Budget allocations by each government will be made annually consisting initially of one million U. S. dollars for the first financial year commencing April 1st, 1984. Subsequent allocations...will be determined by the requirements of the program..."

3. "Projects will be normally funded on an equal-sharing basis of the recognized R&D expenses." This meant that each government will fund 25% of R&D expenses (half of 50% - the usual rate of financial support), even though the actual expenses are never equally divided between the two companies.

4. Departing from the BIRD F formula that each project must involve two industrial companies, the present agreement accepted an industrial laboratory as one (but never both) of the partners. This recognized the fact that in South Africa most of the industrial R&D is carried out by a Research Institute.

5. No Board of Governors was established, since the spirit of the agreement was to leave the approval of projects and other policy matters to the respective governments (thus giving each country veto power over each and every project). However provisions were made for a joint standing committee to oversee the progress of the program.

6. For various reasons the agreement included cooperation in agricultural R&D as well. That type of R&D has different objectives than industrial R&D (commercialization is not a prime requirement), and this was reflected in several paragraphs. Thus a partnership between two laboratories was acceptable in the case of agricultural R&D.

The South African delegation went home, and the two governments assigned OCS and SAIDCOR as the organizations representing the Israeli and South African governments respectively for the purpose of this program, and appointed the Director General of SAIDCOR, Mr. Andreas DeWaal and myself as the respective program managers. After that we were left to our own devices.

Shortly thereafter, Mr. DeWaal came to visit Israel, and I organized for him an extensive visit at science based, innovative industrial companies. Our conclusion was that South Africa was more advanced in certain technological fields, mainly mining and other heavy machinery and equipment, as well as synthetic fuels, while Israel had far more experience in industrial R&D proper, in a large variety of fields. We agreed therefore that we should be rather flexible in using the term R&D to include engineering, thus making cooperation possible and beneficial to both parties. Since I was more experienced in binational cooperation (due to my familiarity with BIRD F), it was decided that I should be writing the principles of operation, and send them to South Africa for approval.

I set cheerfully to copy the principles of operations of BIRD F, which have been refined by experience. The preparation of the proposal I copied almost verbatim, since it is extremely well written, and I found little if anything to correct. But, as a result of the different nature of the two agreements, I soon encountered two important difficulties:

1. Since there was no Board of Governors, I suggested that every country operates according to its own rules. Not completely so, the Israeli company will not use our regular application form; we shall always insist upon a joint proposal, so that when we evaluate a project, we have before us a complete picture of the whole project, and how it will be executed. Beyond that however, we shall evaluate the project according to our criteria, including production in and export from Israel. We might go a little easy on the innovation, and include functions which we ordinarily classify as engineering. We would also go a little easier on the budget approval, and be more liberal with foreign travel. Beyond that we would use our ordinary procedure (including approval by the Research Committee). SAIDCOR will use their own procedure and their own criteria for project approval, with whatever modifications they deem necessary. The two program managers will exchange telexes, informing each other of the respective decisions, maybe discuss a little the budget or the rate of repayment, and reach a consensus. This procedure assures each organization the veto power, just as foreseen in the agreement between the two countries.

2. A more difficult problem was the one I called "who signs what with whom?" BIRD F is a legal entity, and as such it can sign contracts and make payments. In our case the "program" is not a legal entity, and only the organiztions can sign contracts. Left to their own devices, the

lawyers (Oh, the lawyers!) will insist that each project involve five contracts (each company signing with two different organiztions, plus the agreement between the two companies), which of course would be unacceptable. What is even worse, in the case of two distinct companies, you will have difficulties in finding someone to talk to in case of problems, say about repayments. The way I suggested to solve this problem was by introducing the concept of "prime contractor", which would usually be the company which performs most of the R&D. The respective agency in that country (OCS or SAIDCOR as the case may be) becomes "prime organization", and the prime contractor signs one agreement with the prime organization. From that moment on, it represents the partnership in all matters, and becomes responsible for all obligations.

This was later modified to some extent, especially in regard to payments: Theoretically, the prime contractor, say the Israeli company, would have to accept all payments on behalf of the partnership from the OCS, and then transfer the proper share to the South African company. The OCS will have to be reimboursed by SAIDCOR for that share, making it all ver complicated. In order to avoid all that, the prime contractor gives the other company a power of attorney to receive payments, and thus OCS pays the Israeli company, and SAIDCOR pays the South African company. The lawyers insisted that all payments are received on behalf of the prime contractor.

It was deemed necessary to incorporate all the principles of operation of the program in a Cooperation Agreement to be signed by the respective agencies responsible for the program, namely SAIDCOR and OCS. What with two teams of lawyers sitting thousands of miles apart, the drafting of the Agreement took close to a year. The final ratification of the original memorandum as well as the Cooperation Agreement by the respective governments, took place in January 1985.

The Cooperation Agreement describes in some detail the Program of cooperation in industrial and agricultural R&D, assigns the agencies responsible for its implementation, and appoints the program managers. Since we had extensive experience with BIRD F, several sections are closely modeled after the corresponding ones in the Agreement between the Governments of U.S. and Israel. Thus section 7 reads:

"A. The operations concerning the Program shall consist mainly of selection, approval and monitoring of projects funded in whole or in part by the Program. All proposals for such projects shall be submitted through the Program Manager to SAIDCOR/OCS for approval.

B. Each proposal considered by the Program Manager shall:
   1. be submitted by a prime contractor representing an Israeli and South African company.
   2. show a mutually beneficial relationship between Israeli and South African entities.
   3. demonstrate the technical and economic feasibility of the project.
   4. contain evidence that the applicant(s) is capable of carrying out the project either alone or through partial subcontracting

to universities, industrial research institutes or other qualified entities, and

5. indicate that the applicant(s) will contribute, from its own resources available to it, a significant portion of the financial resources required to carry out the project.

C. Each proposed project shall:

1. promise a tangible, direct benefit for the national economies of Israel and South Africa, such as significantly increased exports, maximized value added or new markets;
2. be of interest to both Israeli and South African industry, because, for example, it could result in a new need in the world market being met or the exchange of materials between Israeli and South African industries being increased.
3. be of general interest to an entire industrial field;
4. directly or indirectly contribute to additional development of products, processes or markets, and
5. have tangible, direct benefits for both countries. A project shall be considered to have tangible, direct benefits for both countries, if it meets one of the following criteria:
   a. it is submitted jointly by an Israeli and South African company or by a joint venture of Israeli and South African companies represented by a Prime Contractor.
   b. it will require expenditures for goods and services in both countries."

There are however some problems specific to this Program that are included in the agreement. Thus the concept of the Prime Contractor is reflected in section 4:

"...If the proposed Project is to be carried out in Israel in whole or in gross part (minimum 51% of the total recognized and approved research and development expenditures of the total project) the Israeli company carrying out the Project will sign an Agreement as a Prime Contractor representing both itself and the cooperating South African company with OCS, maintaining the rights of SAIDCOR and representing the Program according to this Agreement...(the section is repeated for the other possible case as well)."

The method of payments, including the equal sharing of R&D expenses by the two governments is reflected in section 4:

"...The procedure of payment of the recognized and approved research and development expenditures of each project will be as follows: SAIDCOR will pay the expenditures of the South African company normally up to 50% and will be repaid by OCS all monies exceeding 25% of total expenditures of project once every three months in order to maintain an equal sharing basis.

OCS will pay the expenditures of the Israeli company up to 50% and will be repaid by SAIDCOR all monies exceeding 25% of total expenditures of project once every three months in order to maintain an equal sharing basis.

All monies paid by the Office and SAIDCOR to the local companies will be linked in value to the official rate of exchange of the U.S. dollar until the date of repayment.

The amount of money to be paid and the time to pay will be according to the Agreement between OCS/SAIDCOR and the Prime Contractor.

Each side (OCS and SAIDCOR) will be entitled to set off any amount that will be due to him from the other side before carrying out the above procedure of repayment. The procedure of repayment shall be repeated once every three months until equal sharing basis will be retained."

Another very important comtract is the Funding Agreement which is signed by SAIDCOR and the Government of Israel as represented by the OCS, both organizations represented by one of them as the Prime Organization, and the two cooperating companies, represented by one of them as the Prime Contractor.

This is a very elaborate document, modeled after the corresponding one used in BIRD F projects. It is 27 pages long, plus three annexures: the Approved Programme (as approved by the two organizations), the Project Budget (approved as above), and the method of payment. The Agreement opens with a lot of definitions, and then it goes on to say that the two ORGANIZATIONS (I shall capitalize the defined terms) will pay the CONTRACTORS 50% of the approved budget. The CONTRACTORS will use that money only within the approved budget, and provide the balance. They will duly make financial and technical reports, not publish the results, and generally adhere to all the above mentioned principles of operation. In case of economic success, they will pay back 150% of the Conditional Grant according to the BIRD F formula - 100% within 4-5 years, and the balance at half the original rate. I would like to highlight a few passages which bring out some of the innovative elements in this Program:

The concept of the PRIME CONTRACTOR and PRIME ORGANIZATION is brought forth in the following paragraphs:

"1.3 Although either OCS or SAIDCOR may sign this FUNDING AGREEMENT as PRIME ORGANIZATION on behalf of the other, both shall be deemed to have the same rights and obligations under this Agreement either by direct authorization or delegation or by indirect assumption in terms of the general intention of the PROGRAMME, and any payments made in terms of this Agreement by one ORGANIZATION shall be deemed to be a release from the joint responsibility of both ORGANIZATIONS under this Agreement. Likewise any benefits received by one in terms of this Agreement shall be deemed to be a defrayment of their joint entitlement under this Agreement.

1.4 Although either of the two CONTRACTORS may sign this FUNDING AGREEMENT as the PRIME CONTRACTOR on behalf of the other, both CONTRACTORS shall be deemed to have the same rights and obligations under this Agreement either by direct authorization or delegation or by indirect assumption in terms of the general intention of THE PROGRAMME, and any payments made in terms of this Agreement by one CONTRACTOR shall be deemed

to be a release from the joint responsibility by both CONTRACTORS under this Agreement. Likewise any benefits received by one in terms of this Agreement shall be deemed to be a defrayment of their joint entitlement under this Agreement. Both CONTRACTORS are responsible for ensuring that the foregoing reciprocal entitlement and liability are clearly provided for in the PROJECT AGREEMENT between them."

Indeed the Project Agreement, which is the Agreement between the two cooperating companies, is very important, and will be elaborated later in this chapter. It is referred to in the following paragraph in the Funding Agreement:

"1.5 Two copies of the PROJECT AGREEMENT shall be submitted by the CONTRACTORS to the PRIME ORGANIZATION for scrutiny no later than 14 (fourteen) days after the CONTRACTORS have been advised that their PROJECT PROPOSAL is acceptable to the ORGANIZATIONS. This FUNDING AGREEMENT shall not be signed by the PRIME ORGANIZATION until both ORGANIZATIONS are satisfied that the general interests of both CONTRACTORS and South Africa and Israel have been provided for on an equitable basis in the PROJECT AGREEMENT."

The payments problems introduced by the concept of Prime Contractor, and their solution, are reflected in the following section:

"2.3 Both the PRIME ORGANIZATION and the PRIME CONTRACTOR may respectively delegate to the ORGANIZATION and the CONTRACTOR in the other country, their powers to make and receive respectively, such payments in local currency as are necessary in terms of the PROJECT BUDGET to implement the part of the APPROVED PROGRAM which has to be carried out in the other country."

The two companies undertake a number of obligations, most of them self evident. There are however a number of paragraphs restricting activities which may be used to evade repayment, or sell know-how without authorization. They are worth quoting:

"7 ...the CONTRACTORS hereby undertake:...

7.11 not to enter into negotiations for the disposal, either wholly or in part, in any shape or form, of their interest in the PROJECT without the prior written consent from both ORGANIZATIONS.

7.12 not to enter into negotiations to be taken over wholly or in part by some company, person or persons at present unconnected with their existing attachments or affiliations without the ORGANIZATIONS' written consent.

7.13 not, without the prior written consent of the PRIME ORGANIZATION to sell any article within the definition of SALES PRODUCTS to their holding or associate companies on terms less favorable to the CONTRACTORS than the terms they would have accepted had it negotiated with an outside company on an arm's-length basis.

7.14 not, without the written consent of the PRIME ORGANIZATION, to purchase any goods, materials or services from their holding or associate companies on terms less favorable to the CONTRACTORS than the terms they would have accepted had it negotiated with an outside company on an arm's length basis."

etc., etc., all the way to 7.19.

The two Program Managers (myself and Ret. Brig. General Jan Willers who had replaced Mr. Andreas de Waal in early 1984) have devoted a great amount of time to negotiating all those Agreements, first between ourselves, and then with our respective legal counsels. But we also managed to work hard at our main function - matchmaking between Israeli and South African companies, and promoting joint projects in industrial research and development.

The way we did that, was first to give the program maximum publicity, via lectures, newspaper articles, a newsletter published by our Office, etc. This, coupled with our general familiarity with our respective industries, brought forth many potential candidates, some of which we have visited together, most of whom we had separate talks with. Whenever an industrialist would visit the other country, we would refer him to the Program Manager, who would arrange for him visits with companies who might be interested in cooperation.

As soon as I spotted a potential candidate, I asked him to prepare a pre-proposal. This would be a 1-2 pages long document, describing the project he had in mind, its technological and economic aspects, and what kind of cooperation he is looking for. I would send this material, together with some catalog or brochure describing the company and its products, to my colleague in South Africa, and ask him to look around for a potential partner. Of course this worked both ways. Many times we would be helped by the fact that the company could pinpoint a potential partner, either through personal connections, or from his knowledge of the field.

Thus I have sat with countless company executives, describing to them the program in the general lines that have been mentioned above, answering questions, explaining how to prepare a Proposal, etc. During these conversations, I have encountered several problems, I would like to relate:

1. Again and again I had to explain that the name of the game is Research and Development. Many people came to see me hoping to find marketing outlets, or other forms of cooperation. We could and did apply some flexibility to the concept of R&D, but we could only go so far.

2. Since this is a binational program, there must be a reasonable division of tasks between the two cooperating companies. This could never be a 50%-50% division, but neither is a 0%-100% division acceptable. In other words, each company had to make a meaningful contribution to the project, and we arbitrarily agreed that the acceptable minimum would be one third of the work (as reflected in the approved budget). Since in many

projects most of the R&D proper was conducted by one of the companies (where the idea had originated), we were very liberal in our definition of what constitutes R&D, and included such functions as preliminary market surveys, specification of products, adaptation of technology, field tests, a number of prototypes, etc.

3. We would urge the companies to start early in negotiating an equitable Project Agreement. This Agreement spells out the business plan of commercialization of the product, should the project succeed. It must be as equitable as possible, and show a clear benefit to both companies and to both countries. An ideal Agreement would provide for production by both companies (we would always insist on production in Israel), and a clear, equitable division of the world markets. As I have mentioned before, the Agreement has to be approved by both Program Managers as equitable, before a Funding Agreement can be signed. My experience shows that drawing a Project Agreement takes a lot of time (of course, since lawyers are involved), and in most cases it unduly delays the signing of the Funding Agreement.

4. Experience has taught me to show the Funding Agreement whenever a serious potential candidate is involved. The company always cosults its legal counsels, and usually those people have plenty of remarks. On minor points we could usually acommodate them, and make minor changes in the Funding Agreement. But major changes are almost impossible, since too many people, thousands of miles away, have to agree. The very first project that was to be carried out within this Program, was cancelled out in the last minute (after a lot of work has been invested in preparing and approving the proposal), because the legal counsels of one company did not agree to the Funding Agreement.

5. During our work, we encountered several people who wanted to act as go-betweens. These were entrepeneurs or lawyers (but not company owners), who wanted to assist in the matchmaking for profit. In principle we agreed to cooperate with such people (after all they assist us in our work), but any profit will be never subsidized by the Program. I tell them that I have eagle eyes, and if I spot their name in the Proposal as "consultants" or something similar, I erase it immediately.

Through our work during 1984, we identified 40-50 potential projects, a dozen of which looked very promising. By early 1985, when all Agreements had been ratified by both governments, we had in our hands several good proposals. By August 1985 we had two projects running (one in Computer Aided Instruction and one in computerized irrigation), and two more projects (one in algae growth and one in water management) had been approved in principle, pending the signing of Project Agreements. Since in the case of BIRD F it also took a couple of years before the first projects had been approved (and there they had an Office with able full time employees), we regard our work as successful. We expect the program to develop and expand for the mutual benefit of both countries.

AGREEMENTS WITH FRANCE, HOLLAND AND CANADA.

Binational agreements related to industrial R&D do not necessarily have the joint development of innovative products as their prime objective and often have strong political background and overtones. Thus the recently signed agreement between the U.S. and India was probably intended to strengthen the economic and other ties between the two countries, and at the same time promote joint projects in industrial R&D.

Israel has more than its share of difficulties in fostering strong economic ties with other countries, caused mainly by the Arab political and economic boycott. Many industrial companies are (unjustly) afraid that by establishing a commercial relationship or a joint venture with an Israeli company, they stand to lose potential customers in Arab countries. For much the same reasons, certain countries are reluctant to enter formal agreements with the State of Israel.

In the case of industrial R&D, the response has often been more positive. Israel has a well deserved reputation for original and innovative industrial R&D, and it can point out with pride to the experience and success that it has with BIRD F. It can rightly suggest that this type of binational cooperation is mutually beneficial, and it initiated several agreements, similar, but far from identical with BIRD F. I would like to describe three such agreements.

FRANCE

France is particularly suitable for binational cooperation with Israel. Its program of government support for industrial research and development is quite similar to that of Israel, and the government agency in charge of that program, ANVAR, resembles OCS in objectives, principles of operation and criteria for project approval, to a degree not found in other developed countries. Furthermore, France has a long history of cooperation with Israel in many fields, including scientific research, and is well aware of the high level of Israeli science and technology. And last but not least, France is aware of the special ties between the U.S. and Israel, knows of BIRD F, and feels that strengthening relations with Israel, will provide access to U.S. technology as well.

Thus the fact that France was very reluctant to enter a formal agreement of cooperation in industrial R&D, can be attributed mainly to its fears of the Arab boycott, although they never said so. It chose to ignore or to downplay Israeli overtures in this respect, overtures that were not completely apolitical either. After several years of fruitless but not very intensive discussions, Israel submitted a formal proposal for cooperation during the visit of President Mitterrand to Israel in early 1982. The document, modeled after BIRD F, has become a prototype for later similar proposals, and it is worth describing in some detail.

The document starts with a preamble outlining the principles for cooperation, and the mutual benefits. After that, it continues to outline the objectives and financial structure of the Foundation:

"The Foundation will encourage ... joint industrial R&D ... in several areas":

1) The promotion of the production and export of technologically sophisticated products.

2) The development of new advanced technologies.

3) The promotion of the employment of highly qualified personnel in science-based industries.

The Foundation will be authorized to finance all stages of applied research and product development through which an innovation becomes a commercial product.

...It is suggested that the yearly budget of the Foundation should be US $5 million to be shared equally by the two countries. France and Israel will undertake the obligation to budget the Foundation for five years, and after that period the whole project will be re-examined."

This is of course very similar to the BIRD F format, with the important difference that the Foundation is financed directly by the two governments, rather than by the interest on an original endowment.

The sections of the proposal dealing with Administration are almost identical with the BIRD F format, including the Board of Directors, its functions, its periodic meetings, the appointment of an Executive Director and his responsibilities. The similarity with BIRD F is very evident in the sector describing the operation of the Foundation:

"The Foundation's primary activity shall be the selection, approval and monitoring of projects to be funded. Projects may be submitted by industrial companies and industrial research institutes.

...the Foundation will attempt to match collaborators for joint research projects. The final decision on whether or not to fund a proposed project will be made by the Board of Directors based on the recommendations of the Executive Director. The grants will cover only parts of the research and development expenses, the exact share to be determined by the Board of Directors.

The grants and loans financing approved will be disbursed according to the progress of the research. Part of the original allocation by both governments will be used for administrative expenses of the Foundation."

This proposal (translated into French - of course!) was duly submitted by the Israeli Foreign Minister Mr. Y. Shamir to his French colleague Mr. C. Cheysson, and I heard that it was singled out by the latter as 'the best proposal among dozens of other proposals for cooperation submitted by the various Ministries'. Nevertheless we heard nothing more about it, and all enquiries by Israeli officials concerning follow-up were met with 'I have no answer'.

Slowly the French evasions took the following pattern: Why do we need a formal agreement or a Foundation? If French and Israeli companies want to cooperate, let them do so: the Israeli company will get its financial support through the OCS, and the French company from ANVAR. Our answer was that cooperation does not occur spontaneously, that the executive director of BIRD F and his staff work very hard in order to generate joint proposals, that without some formal organization, nothing will happen. The French started hinting that they would be willing to consider an agency charged mainly with match making.

The discussions received a much needed push, as the French Minister for Industry and Development, M Laurent Fabius (today Prime Minister of France), prepared for a visit to Israel. Ministers like to use such occasions in order to sign documents, and what could be better than one related to high tech and industrial R&D. But when I saw the draft of the letter of intent proposed by the French, I was very disappointed. The French suggested the establishment of a French Israel Association for science and technology. It would be charged with the promotion of cooperation in scientific and technological research, and it would have a budget of $200,000 a year for administrative expenses. The word "industriel" did not appear, and the spirit was of cooperation mainly between universities and research institutes.

I did not like this document at all, and wrote a memorandum urging our Minister to reject it. I pointed out that cooperation in scientific research between academic people requires no match making operation. Scientists know each other pretty well, and if the need for cooperation arises and funds for the project are available, they will go for it without the benefit of our Association. It is different in the case of industrial R&D, when two private companies are involved; they have to contribute their own share to the budget (usually 50%), and there are a lot of nagging questions about economic feasibility, manufacturing facilities, marketing, etc. Neither did I like the forced "marriage" between scientific and technological (which I hoped meant industrial) research, since in Israel, (and a few months later in France as well), these come under different Ministries, with all the beaurocratic problems involved.

Cables started flying between Jerusalem and Paris, especially since the Foreign Office people were eager to sign. The word "industrial" was introduced 3 times, the words "industrial companies" once, and even though I still had misgivings, the Ministers happily signed the letter of intent expressing their willingness to establish the French Israeli Association for Scientific and Technological Research. Two more meetings (several months apart) between "experts", and the Association was born.

The by-laws of the Association form a 9 pages long document, in French. After a short preamble, it goes on to describe the objective of the Association:

"-to promote the contacts and exchanges between persons and research institutes, universities, and industrial enterprises under the juris-

diction of the respective parties.

-to encourage and sustain cooperation in scientific and applied research as well as technological innovation between persons and bodies as mentioned above.

-to facilitate ... the circulation of information ...

-to direct eventual partners in a joint project to the relevant organizations in the respective countries, charged with the approval and financial support of projects according to regulations and procedures existing in each country."

After this there are several paragraphs describing at great length 5 (!) different types of membership in the Association: how one becomes a member and how one stops being a member (one of the methods to stop being a member is by dying); the resources (mainly governmental support) and the budget of the Association; a long paragraph describing the composition of the Board of Directors, composed mainly by representatives of the various Ministries; the Presidency of the Association which rotates between the two countries; the functions of the Board of Directors, and the mechanism for decision making; etc. etc.

The administration of the Association is of some interest: the main office was established in Paris, and a corresponding office in Tel Aviv. The Chief Executive Officer (called Secretary General) is French, and the first one to be appointed was M. Edmond Giele. He was to appoint three Associate Secretaries: one to reside in Paris, and two in Israel, one for scientific research, and the other one for technological industrial research. All the Secretaries, with the exception of the one dealing with industrial R&D, will be government officials, and serve without salary. I tried to incorporate into the by-laws a document describing how the Association is going to operate in order to fulfill its function as a matchmaker in industrial R&D which I regarded as by far its most important function. Somehow this fell during negotiations, the French maintaining that "all this is self evident" (even though most other paragraphs looked to me a lot more self evident), and my two pages long document was condensed into three sentences which constitute paragraph 5b:

"In the technological field, the Association will try to identify French and Israeli partners interested in cooperation, and will bring to their attention, if they so desire, lists of potential projects which could be jointly submitted to the proper authorities in the respective countries. The Association will help to adapt the applications to the regulations and modalities of the different organizations. It will try to facilitate the decision making process, and engage in follow-up."

The Association was duly registered in October 1984, with a very distinguished Board of Directors: The French side appointed Prof. J. Cohen, President of Pasteur Institute and Scientific Advisor to the Prime Minister, as the temporary President of the Association, and Prof.

responded by appointing as the next President, Prof. E. Katzir, an equally famous scientist, and an ex President of the State of Israel. Equally important, the Chief Scientist at the Ministry of Industry in Israel, as well as the President of ANVAR on the French side were appointed as members of the Board, and their interaction went a long way in facilitating cooperation in industrial R&D.

I still feel that the Association has many superfluous functions, and it does little, if anything to promote scientific cooperation, which can and does proceed very smoothly without the benefit of the Association. It seems however that ANVAR looks upon the Association as an official blessing by the French government for cooperation in industrial R&D with Israel. They still insisted on their own forms (in French), rather than a joint application, and did not like the idea of equal sharing of R&D expenses (as in the case of South Africa). But they agreed to recognize subcontracting in Israel as legitimate R&D expenses of a French company, and in general became cooperative. Within a few months the first cooperation agreement was signed between a French company specializing in welding and an Israeli startup specializing in commercial power lasers. The project is being financially supported by ANVAR and the OCS respectively. Several other agreements are in the pipeline, and it would seem that the establishment of the Association did a lot to promote directly and indirectly, cooperation in industrial R&D between the two countries.

HOLLAND

In late 1984 the respective Ministers of Israel and Holland expressed their interest to sign an agreement related to cooperation in industrial R&D. It seems that Holland had just reorganized its mechanism of support for innovative ideas. The Directorate of General Technology Policy of the Ministry of Economic Affairs is an organization with objectives and principles of operation very similar to those of the OCS in Israel.

The ground was ready. We already had in our possession a proposal which had been previously prepared for the French, and which had been described in some detail earlier in this chapter. We introduced a few cosmetic changes, in order to adapt it a little better to the Holland situation, and added two other options for cooperation:

"1) One possibility is that instead of allocating a yearly budget by each country, both countries deposit in the Bank of Israel a lump sum of say U.S. $10 millions. In that case the projects can be funded by the interest from the deposit, after deducting administrative expenses.

2) A different version of this program would be to avoid establishing a foundation, and to run a program of cooperation in Industrial Research and Development. In that case each country will designate an organization which will run the program, as well as a program manager. The organization will usually be a government department, and the program manager will usually be a government official, and the will jointly run the cooperation program.

The funding of the projects in this case will be made by the respective organizations in both countries according to their own rules. In Israel this will be the Office of the Chief Scientist..... A small amount of money should be appropriated for special administrative expenses.

The advantage of this version is that it saves a lot of money: the salary of the Executive director, secretaries, office rental, etc. All these expenses can be absorbed by the government. The disadvantage is that there are several legal and logistic problems involved, but we believe that they can be overcome."

The first option describes of course the exact BIRD F format, including the original large endowment by the respective governments. Since this involves a large initial investment of money, it was soon to be rejected, and indeed it was. The second option describes a program similar to the one we operate with South Africa, and this is the option which was finally adopted, with some changes.

In March 1985 an Israeli Delegation visited Holland and signed a Memorandum of Understanding. After a short preamble it goes on to say:

"II. The scope of the industrial research, development and production activities, which the program may promote and support shall include all applied science activities in the process through which innovation technology commercial products, including but not limited to product engineering, manufacturing, start up, facilitating, market research and market development. These activities shall be preferrably carried out by two countries by companies, consortiums of industry and technology or private or government owned research institutes and universities.

III. The authorities responsible for the creation and implementation of the programs will respectively be the Chief Scientist' Office of the Ministry of Trade and Industry (OCS) on the Israeli side, and the Directorate of General Technology Policy of the Ministry of Economic Affairs (TP) on the Netherlands side. OCS and TP will each establish in the respective countries a committee to which the execution of the programme is delegated: a Netherlands committee (NC) and an Israeli Committee (IC). Both committees will be part of the Joint Committee for Technological Cooperation. The joint committee will meet at least once a year alternatively in Israel and in the Netherlands. In order to facilitate the contacts, each side will appoint a person responsible for the daily work and smooth running of the cooperation.

IV. The Netherlands and Israeli committees (NC and IC) will have the following aims:

- Develop criteria in order to evaluate and approve the proposals
- Assist in the application according to national rules, and procedures for either loans or grants of different origin, to finance the projects.
- Create a system of exchange of information within the Committee and

with the representatives of the two ministries in order to direct and monitor the progress of the projects
- Actively promote the contacts and exchange between companies, organizations of private or governmental origin in industry and technology, research institutes and universities in the two countries in the field of industrial research and development
- Develop ideas together with individuals and/or organizations of aforementioned nature, which might lead to joint projects on all applied science activities to the benefit of the two countries in areas as described in II
- Facilitate communication by providing information on relevant subjects in order to promote existing projects and/or potential candidates for new projects
- To gather information about the technology policy in general in the two countries.

V Each side will try to make available a yearly budget in order to finance:

- the activities of the local committees and the Joint Committee for Technological Cooperation
- temporarily agreed projects, in case the start up of such projects needs financing in an early stage.

For 1985 each side has made available an amount of U.S. $25,000. This amount will be the guideline for the coming two years as well.

VII. In order not to delay the cooperation, this present Memorandum of Understanding will be effective until a new document has been signed with a more detailed description of goals and procedures for this bilateral cooperation."

And indeed the negotiations with Holland have proceeded very smoothly, free from political overtones, with plenty of good will on both sides. It was felt that a genuine benefit will be gained by both sides, and the Memorandum of Understanding was implemented as soon as it was signed. Even though a more elaborate agreement was in the pipeline (and may already have been signed), this Memorandum proved enough. The first cooperation agreement between an Israeli firm specializing in security equipment, and a Dutch firm specializing in communications software and hardware was signed within weeks (and duly supported by the respective organizations), and several other agreements are in the pipeline.

CANADA

Negotiations for an agreement with Canada started in 1981, long before all the other agreements except BIRD F. Not only did negotiations drag on and on, but when an agreement was finally signed, it proved erroneous in concept. The program with Canada has yet to produce its first joint project, and I will be greatly surprised if any viable project does materialize in the near future. Nevertheless one should briefly analyze this program since one can constructively learn something from its failure.

The idea was to establish an Institute that would serve as a match making operation to promote joint projects in industrial research and development between Israeli and Canadian companies. Each government was to contribute U.S. $200,000 over a period of three years to finance the activities of this Institute, and after that period the Institute was expected to cover much of its expenses though fees it will charge for its services. This was reflected in the following paragraph in the agreement:

"1. b) The purposes of the Institute shall be, inter alia,:

(i) to promote and facilitate joint research and development projects;
(ii)to promote and facilitate the commercial exploitation and marketing of the results of such projects by companies in Canada and Israel; and
(iii)to earn revenue from royalties and by charging fees for information, for services, arranging or managing projects and in some cases, by taking shares in new companies that are established."

The agreement goes on and on to describe the composition of the Board of Directors of the Institute, how it meets, how the respective governments provide the money, and how the money is to be used (mainly for administrative purposes).

Several basic mistakes were made here:

1. For various political reasons, the Canadian government did not wish to sign a direct agreement with the Israeli government. The Israel Canada Chamber of Commerce, which had been very active in promoting this program, and was instumental in getting the Canadian government interested in this venture, soon carved for itself a central role in the operation of this Institute. The Chamber arranged to sign separate agreements with the respective governments, and managed to become their trustee for the purpose of this Institute. Very soon the Chamber found a raison d'etre in this Institute, and what is even worse, a solution to some of its financial and personnel problems. Soon it was difficult to distinguish between the organization and the finances of the Chamber and the Institute.

2. All the organizations coordinating joint R&D programs (whether they are called Foundations or Institutes or something else), depend to a crucial extent on the personality of the Chief Executive Officer. The Chamber first appointed its own executive director to that job. This resulted in lot of bickering, and he resigned. The Chamber brought a lot of pressure to appoint a distinguished member of its own Board, a retired, elderly, respectable businessman. Again it did not prove a successful appointment, and he resigned a year later. The bickering continues.

3. The people who have conducted the initial negotiations were mainly politicians, and they have failed to study thoroughly the system of government support for industrial research and development in Canada.

It turns out that unlike Israel, France, Holland, and even South Africa, Canada does not have a system of direct government support (it does have a system of indirect support through tax breaks). The main incentive built in all those programs is getting some financial support from the government, who thus shares the risk involved in industrial R&D. It is inconceivable that joint projects in the Canada-Israel program will be directly supported by the Israeli government only.

4. It may be unrealistic to expect an organization engaged in matchmaking in industrial R&D to earn a major part of its expenses by charging fees. Most of the services it might offer, are available for free elsewhere. Suppose an Israeli company is looking for a potential partner in North America. Why should it apply to the Canada-Israel Institute, when BIRD F is doing match making work for free?

The situation now is that we have all learned from the unsuccessful experience of [illegible], and the Institute is in the process of reorganization. Only time will tell if its built-in problems are soluble at all.

Despite the Canadian example (and it may be a psychological mistake to bring this failure as a last example), I am a firm believer in binational cooperation in industrial research and development. All other programs are operating satisfactorily to the mutual benefit of all parties. The agreements reached between companies have ramifications and benefits that extend far beyond industrial R&D into joint ventures related to production and marketing. The indirect benefits to the economies of participating countries have been analyzed in detail in the chapter about BIRD F, and there are additional political and other beneficial aspects. The world as a whole benefits as the result of the introduction of technologically sophisticated innovative products.

Unlike mineral reserves, intellectual resources increase in power and value the more they are used. And the leverage of these resources when intelligently applied as R&D inputs to industrial growth, is of the kind that moves economic mountains.